

# **U.S. ARMY ENGINEER RESEARCH AND DEVELOPMENT CENTER**

## **BACKGROUND**

The research and development laboratories of the U.S. Army Corps of Engineers have served the Corps, the Army, and the Nation with technical accomplishments in a variety of engineering and scientific fields for more than 75 years. From beginnings in 1929 as a small hydraulics laboratory established to assist in developing a comprehensive plan for flood control of the Mississippi River to the 1999 establishment of the Engineer Research and Development Center (ERDC) consolidating the research and development efforts of the laboratories under the leadership of a single center, Corps' laboratories have been solving civil engineering and environmental quality challenges. ERDC is headquartered in Vicksburg, MS, and offers a centrally managed center of seven laboratories that is the largest and most diverse civil engineering and environmental sciences research and development organization in the world.

During FY05, ERDC had 1736 full-time permanent employees of whom 1036 are highly trained engineers and scientists. The full-time permanent professional staff encompassed 283 Ph.D.'s and 431 Masters' degrees.

ERDC executed a Civil Works program totaling \$138 million. Of this total, \$65 million was executed in direct-allotted programs, with \$32 million in R&D programs and \$33 million in technical support programs. The remaining \$73 million was executed in support of USACE District and Division offices.

## **LABORATORIES**

The diverse civil engineering and environmental quality research and development center consists of seven centrally-managed laboratories located at Alexandria, VA; Champaign-Urbana, IL; Hanover, NH; and Vicksburg, MS. With world-renowned expertise and facilities, each laboratory adds a unique perspective and set of capabilities to the overall ERDC team.

### **Coastal and Hydraulics Laboratory**

The Coastal and Hydraulics Laboratory (CHL), Vicksburg, MS, is the Nation's center for engineering and scientific research and development in the coastal, hydraulic, and hydrologic engineering and sciences. It conducts research and supports the Corps of Engineers in conducting its navigation, flood and coastal storm damage reduction, environmental restoration, and military engineering missions. CHL is comprised of nationally and internationally recognized experts that perform research and site-specific investigations in the fields of rip-rap design; navigation engineering; pump station design; fisheries engineering; sediment transport; estuarine engineering; dredging; hydrodynamics; groundwater, watershed, and surface water modeling; coastal storm and flood damage protection; harbor design and modification; coastal and hydraulic structures; physical processes associated with water resources; environmental problems; military logistics-over-the-shore; wave climatology; and hydroinformatics.

### **Cold Regions Research and Engineering Laboratory**

The Cold Regions Research and Engineering Laboratory (CRREL), Hanover, NH, maintains the finest research and engineering staff and facilities in the world for the study of cold regions science and technology. CRREL is recognized for its internationally known experts in the field of ice jam flooding and ice-hydraulics; ice control at locks, dams and other navigation channels; snowmelt modeling & simulation; and other areas ranging from geotechnical aspects of frozen ground to new admixtures for placing concrete in the winter. CRREL's specialized research facilities include a complex of cold rooms, an Ice Engineering Facility housing three special-purpose research areas; a large low-temperature towing tank, a refrigerated flume for modeling rivers, and a large hydraulic-model room. CRREL is also home to the U.S. Army Corps of Engineers Center of Expertise for Civil Works Remote Sensing/Geographic Information Systems.

### **Construction Engineering Research Laboratory**

The Construction Engineering Research Laboratory, Champaign, IL, provides construction research to address the entire spectrum of issues within military construction. This research is in support of sustainable military installations and encompasses construction, operations, and maintenance as well as environmental and safety concerns. These technologies have universal application and are of value in the Civil Works arena as well. Civil Works efforts are in the areas of corrosion control, high performance protective coatings (including over-coating of lead-based paint), management tools for Operation and Maintenance optimization, and environmental sustainment.

### **Environmental Laboratory**

ERDC's Environmental Laboratory, Vicksburg, MS, is an international leader in environmental quality and environmental restoration research. Solving problems in these two areas has involved the Environmental Laboratory in evaluating and mitigating the consequences of water resources development, navigation, and dredging on the environment; regulating and restoring wetlands and inland and oceanic water quality; stewardship of natural resources; and managing cleanup of contaminated groundwater sediments and soils.

The Lab provides natural-resource-management technologies to guide Corps stewardship at projects; improved techniques for stream and riparian restoration; research to accelerate growth of desirable, non-problem vegetation; guidance on using biological control agents to manage nuisance aquatic plants; risk-based contaminated sediment and soil toxicological assessment protocols; guidance to Districts on controlling zebra mussel infestations using anti-foulant coatings (paints, thermal metal sprays, etc.), guidance on upland disposal testing and assessment for dredged material, and continuous backwash filter systems for intakes that supply irrigation systems, water supply, and other low-flow requirements.

### **Geotechnical and Structures Laboratory**

The Geotechnical and Structures Laboratory (GSL), Vicksburg, MS, conducts research in soil and rock mechanics, earthquake engineering and geophysics, tunneling and trenchless technology, engineering geology and seismology, vehicle mobility and trafficability, unexploded ordnance detection, and pavement technology. The Laboratory

also determines the response of structures to weapons effects and other loadings, investigates methods for making concrete and other materials more durable and economical, studies the application of explosives technology to military and civilian engineering, and investigates the behavior of earth/structure systems subjected to blast loading and projectile penetration. The Lab is a world leader in research on effects of earthquakes on embankment dams and the evaluation, maintenance, and rehabilitation of mass concrete, steel and reinforced structures.

### **Information Technology Laboratory**

The Information Technology Laboratory (ITL), Vicksburg, MS, advances, applies, and delivers information technologies (IT) that address a wide range of engineering, scientific, and management challenges.

ITL manages one of the four High Performance Computing Major Shared Resource Centers formed under the auspices of the DoD High Performance Computing Modernization Program; and the Computer Aided Design and Drafting/Geographic Information Systems (CADD/GIS) Technology Center for Facilities, Infrastructure, and Environment, a multi-agency vehicle to coordinate CADD/GIS activities within DoD and with other government agencies. ITL is highly recognized for its expertise in the areas of Facilities Management technologies required by Army Civil Works projects; computer-aided interdisciplinary engineering and analysis; computer science applications; scientific visualization (including virtual reality); support to R&D and application efforts requiring sensors, graphic arts and publishing; and collaborative technologies.

### **Topographic Engineering Center**

The Topographic Engineering Center (TEC), Alexandria, VA, provides new topographic capabilities in geospatial science to the Corps of Engineers to ensure superior implementation of the nation's civil and environmental initiatives through research, development, and application of remote sensing, geographic information, global positioning, topographic, hydrographic and information technologies. TEC scientists and engineers continue to develop faster, more accurate, and cost-effective ways to use new remote sensing technologies to describe, characterize, and analyze the surface of the earth. Remote sensing technologies form an essential part of a new national approach to infrastructure engineering and environmental stewardship.

## ARMY CIVIL WORKS R&D PROGRAMS

The Army Civil Works Research and Development program is formulated to directly support the established Business Lines of the Civil Works Program including: flood and coastal storm damage reduction, inland and coastal navigation, environment (including natural resources, compliance, mitigation, and restoration), water supply, hydropower, recreation, emergency management, and regulatory. The Civil Works R&D needs and requirements are identified based on the current Civil Works Program Strategic Plan, Corps divisions and district input, and the existing WRDA authorities. The R&D effort is a problem-solving process by which the Corps systematically examines new ideas, approaches, and techniques and develops field-ready products to reduce costs, speed the time, and improve quality of its planning, design, construction, operations and maintenance activities in an environmentally sustainable manner.

Results of this R&D effort are directly incorporated into practice within the Civil Works Program through revisions or additions to Engineer Regulations, Engineer Manuals, Technical Guidance Manuals, Engineer Technical Letters, or Guide Specifications. Numerous other means of technology transfer are also used such as training courses, workshops, and other professional contacts. The Corps Civil Works R&D Program provides essential Product Lines with field ready end products and a high return on investment for the Corps and the Nation.

In order to most effectively use the limited R&D resources and to avoid unnecessary duplication of research effort, the Civil Works R&D Program maintains external technical exchange and technology transfer efforts with other Federal and major water resource agencies, International Boundary Water Commission, International Joint Commission, the Navy, and state and local governments.

Components of the R&D program include support to the major business lines of the Corps of Engineers. While most of the R&D program is funded through General Investigations, there are several R&D efforts funded through the Operations and Maintenance and the Construction General appropriations.

Under the General Investigations (GI) R&D program, the primary business lines supported by

R&D include Navigation, Flood and Coastal Storm Damage Reduction, and Environmental Restoration. Additional research serves to cut across and support all business lines. In particular, the System Wide Water Resources, Infrastructure, Geospatial, and Decision Support technology development serve multiple business needs.

### GI R&D: Navigation Research Area

The Corps provides inland and coastal navigation critical to the national economy and defense. Additionally, Corps projects provide 25% of the Nation's hydropower. Navigation research, which includes hydropower, delivers tools and guidance essential for improved reliability, increased efficiency and sustainable increased capacity of this complex aging transportation/power network. The research framework integrates water dynamics, infrastructure mechanics, advanced materials, power physics, economics, innovative construction, coastal and riverine processes, automated control and monitoring, remote sensing, operations research, stochastic processes and emerging technologies to create effective solutions in perspective with the multiple demands, requirements and constraints of real world commodity transport and power production problems. Research efforts target navigation channels, locks, jetties, breakwaters, dams and power plants to optimize among life-cycle and reliability trade-offs, assure defensible economic assessment, and provide better investment decision tools for predicting performance and deterioration with time, and scheduling and prioritizing maintenance and repairs balanced with the consequences of delays. FY 2005 accomplishments include:

- Improved coastal navigation structure design with completed upgrade of near-shore wave models
- Reduced probability of dam failure by identifying innovative technologies to detect scour next to navigation dams
- Increased dam safety by updating technical guidance for seismic stability of concrete gravity dams
- Made concrete navigation structure design more cost effective through updated design guidance
- Contributed to better management of economic and engineering risk in inland and deep draft systems through development of more accurate simulation modeling

- Reduced unscheduled lock closures with completed framework for evaluation of service and repairs on steel components of lock gates

#### **GI R&D: Flood and Coastal Storm Damage Reduction Research Area**

As part of its “Flood and Coastal Storm Damage Reduction” mission, the Corps of Engineers is responsible for more than 600 dams, operates over 400 major lakes and reservoirs, maintains 8,500 miles of levees, and has over 100 coastal storm-damage reduction and related projects. Flooding that occurs in the United States costs about \$4 billion annually. Despite all efforts, annual damages in the flood plain continue to rise due to continued urban development. In addition, the 2000 census showed that more than 50% of the US population lives within 50 miles of a coast and is vulnerable to dangerous coastal storms and costly flooding. Consequently, over the past several years, Federal shore protection expenditures increased to more than \$100,000,000 per year to protect the public and related economic investments

The Corps manages existing water resources projects around the country to maintain a flood-protection infrastructure for the public’s welfare. Simultaneously, the Corps balances requirements for hydropower, water supply, environmental stewardship, and recreation. As enabling technologies are developed, the Corps must upgrade and improve water resource projects; the Corps must have the most advanced capability to assess the risk of alternative operational scenarios; and the Corps is expected to apply robust, reliable, and comprehensive capabilities to assess the economic and environmental effects of alternative plans for projects and to select the most balanced and sustainable solutions. R&D delivers efficient and effective capabilities to plan, design, construct, operate, maintain, and upgrade water resources projects in all climates and settings, from warm to ice-affected, and from inland to coastal. Capabilities to prevent loss of life, minimize property damage, and reduce the life-cycle costs of projects are critical. The capabilities include advanced processes and design models, economic models and decision support software, infrastructure condition and risk assessment tools, infrastructure design guidance, innovative operation and maintenance technologies, flood-alert instrumentation and expedient emergency response capabilities, and the capability to take advantage of new real-time data sources (e.g. precipitation radar)

to accurately forecast real-time flow and stages. FY 2005 accomplishments include:

- Integrated Hydrologic Engineering Center (HEC) tools by releasing the beta version of the Water Analysis Tool (HEC-WAT), making hydrologic and hydraulic modeling seamless for project planning studies.
- Provided comprehensive technical input and guidance for the National Teams performing Corps-wide Dam Safety Portfolio Risk Assessment and continued development of tools for risk-based analysis.
- Improved the Corps Water Management System (CWMS) for real time river flow/stage forecasting by Corps Districts which improves project operations and emergency management response.
- Developed new engineering and design guidance to improve channel stabilization measures, riverbed grade control structures, and streambank protection, and for ice-affected rivers.
- Improved the Corps’ collaborative planning process and capability in multiple purpose formulation and planning through the release guidance and support tools.
- Developed risk-based estimation tools for piping & seepage through dams, embankment breaching, and gate operation performance to ensure life-safety under extreme loads.
- Validated the use of numerical simulations for the development of ice-control structures design procedures, and conducted physical experiments on non-floodplain ice-control structures alternative designs.

#### **GI R&D: Environmental Restoration Research Area**

Ecosystem Restoration is a growing focus of the Corps Civil Works program, ranging from large-scale projects such as the Everglades to smaller localized ecosystem restoration projects. In addition, the Corps carries out environmental and natural resource management and restoration activities on more than 11 million acres of land and water resources. The goal of this R&D is to provide Corps field personnel with cost-effective/innovative technologies for project planning, design, engineering, operation, and regulatory activities. Product lines include: Environmental Impact Assessment, Ecosystem Restoration and

Environmental Stewardship and Management. Environmental studies related to Cross-cutting R&D (i.e., Geospatial, Economics, and Risk) are also addressed. Products are concise, how-to guidance documents that provide rapid/low-cost technologies and methods for high priority field needs. This technology is critical to the success of the Corps' Continuing Authorities Program (CAP) as well as larger GI-funded projects. FY 2005 accomplishments include:

- Developed techniques, tools and algorithms for impact assessment of Corps' water resource projects
- Developed guidelines for the planning and removal of dam projects
- Developed ecosystem restoration technologies based on a broad suite of ecosystem processes and functions
- Initiated development of a suite of tools for improved natural resource inventories on Corps land and waters
- Initiated modifications to a regionally-specific approach for prioritizing potential wetlands restoration sites
- Provided U.S. regional hydrogeomorphic guidebooks for depressional, and riverine wetlands in Arkansas and California.

#### **GI R&D: System-Wide Water Resources**

The goal of the System-Wide Water Resources research area is to support all business lines of the Corps of Engineers and its partners by providing the capabilities to balance human development activities with the natural system in a sustainable manner through regional management and restoration of the Nation's water resources over broad temporal and spatial scales.

The capabilities provided herein include science-based water resource management methodologies, implementation guidance, computational frameworks and technologies, and decision support. These capabilities are being built from sound scientific principles reflecting an improved understanding of inter-relationships among key system attributes such as hydrology, geomorphology, chemistry, ecology, and socioeconomic. Capabilities are being served via a seamless, integrated architecture allowing projects to be considered at multiple-scales during project planning, design, construction, operation and maintenance.

FY 2005 accomplishments include:

- Improved watershed models for more comprehensive studies in complex urban and rural landscapes.
- Developed hydrologic toolset for defensible model-parameter estimation, solution sensitivity analysis, and stochastic simulation.
- Developed guidelines for parameter selection for more efficient partially saturated flow simulations over large time-space scales.
- Improved computational hydraulic routines in models to support sediment and nutrient transport.
- Advanced reservoir water optimization tools for balancing multiple stakeholder objectives.
- Improved computational hydraulic routines in coastal models to support sediment transport.
- Sediment transport included in watershed models. Modular algorithm design for interagency use.
- Sediment erosion, transport, and deposition capabilities added to single and multi-dimensional river models. Modular algorithm design used for interagency collaboration.
- Released sediment impact analysis model (SIAM) for watershed stream networks. Rapid analysis of impacts of project alternatives on watersheds is possible.
- Released test-version of new-concept model for coastal shoreline evolution along with advanced Regional Morphology Analysis Package to support it.
- Developed nutrient transport and fate algorithms for watershed and riverine assessment and prediction models
- Compiled tiered ecological assessment tool catalogue with user-friendly access.
- Developed planning level ecological response tools for conceptual models, geospatial watershed assessments, and Total Minimum Daily Load analysis.
- Developed ecological response algorithms that are sensitive to physical, chemical, and biological phenomena over multiple spatial and temporal scales.
- Demonstrated floodplain habitat assessment methodologies in an arid region and initiated assessment methodologies in an eastern region.

- Initiated ecological modeling in complex river systems using trophic-level and agent-based models.
- Developed common data format and procedures for linking selected hydrodynamic codes to selected index, geospatial, and water quality models.
- Integrated statistical methods with Geographic Information Systems to perform regional analysis for watersheds necessary for water resources-related risk estimation.
- Developed a standard approach to the development of graphical user interfaces to support user-friendly interaction with multi-dimensional models.
- Initiated linkages among the riverine, estuarine and coastal hydrodynamic models to broaden the spatial scope to material transport.
- Initiated innovative and emerging measurement and monitoring technologies using hyperspectral imagery and isotopes.
- Developed initial integrated computational and information framework that provides a corporate and standardized structure for efficient utilization of water resource assessment technologies.
- Developed a web-based decision support prototype for system-wide alternatives analysis.

### Other R&D Programs

#### O&M R&D: Aquatic Nuisance Species Research

The Aquatic Nuisance Species Research Program is an expansion of the Zebra Mussel Research Program. Funded under the Operations and Maintenance appropriation, this expanded program addresses all invasive aquatic animal species. Invasive species in general cost the public over \$137 billion annually. Zebra mussels alone cost the public over \$1B annually. It is estimated that over 100 nuisance species are introduced into U.S. waters annually which can impact facility operations and threaten valued natural resources. The Corps is responsible for the construction, operation, and maintenance of navigable waters and the resources associated with them. Methods of prevention and more effective, inexpensive methods of control of invasive species must be developed to prevent

impacts to public facilities and protect valuable natural resources.

Prevention methodology focusing on dispersal barrier technology will be investigated. The development of strategies to apply control methods involves engineering design, operations, and maintenance of facilities and structures. Control strategies are being developed for navigation structures; hydropower and other utilities; vessels and dredges; and water treatment, irrigation, and other water control structures. Methods to reduce invasive species impacts to threatened and endangered species and restore natural habitat will be investigated. Due to the introduction of the Northern Snakehead Fish and West Nile Virus the Corps has experienced a significant increase in the number of field assistance requests at our operating projects. Numerous dredged material disposal areas in the Atlantic, Gulf coast and Great Lakes region have mosquito abatement programs. Due to the introduction of the West Nile Virus local communities want greater assurances that mosquito populations at our disposal sites are controlled to the maximum extent practicable. Following introduction of the Northern Snakehead Fish a number of Corps reservoir projects have had to take interdiction measures to prevent their introduction.

Accomplishments in FY 2005 include:

- Evaluated new methods for the prediction, prevention and control of the red tide.
- Provided guidance on the application of risk assessment and decision analysis to Aquatic Nuisance Species (ANS).
- Evaluated the growth, reproduction, and movement of Asian carp in the Upper Mississippi River.
- Identified potential new chemical compounds to control harmful algal blooms.
- Initiated the application of life stage sensitivity analysis to chemical control strategies for ANS.
- Developed ANS assessment technologies to provide: early detection, threat level, monitoring strategies, management protocols, and exclusion protocols.
- Developed internet/computer-based information system containing ANS species profiles for quick access by Corps resource managers.
- Provided guidance on freshwater ANS impacts, management costs and benefits at Corps' projects.

- Provided regional guidance on potential ANS species in marine and estuarine environments on Corps projects.
- Provided case histories for a retrospective analysis of past zebra mussel management technologies.

### O&M R&D: Coastal Inlets Research Program

Records demonstrate that the Corps will expend an estimated \$8 to \$10 billion over the next 25 years at the more than 150 tidal inlets with existing Federal navigation projects to maintain, modify, and create navigation channels and structures, and to mitigate damages to adjacent beaches. In addition, the national “2020” plan for deeper and wider channels to accommodate the next class of vessels brings great uncertainty in prediction of maintenance requirements. Political, engineering, and demographic factors may increase costs. The public perception, right or wrong, that Federal activities at inlets cause adverse response at adjacent beaches may require additional, expensive mitigation. Public sensitivity to current maintenance practices, where dredged material is placed in offshore disposal areas, may result in requirements for more nearshore placements of maintenance materials to benefit adjacent beaches. Inlets are the primary conduits for the transport of environmental constituents between bays and the open ocean, and the Corps may be constrained from performing present activities unless it can make accurate predictions of inlet response, and thus environmental response, to such activities.

The Coastal Inlets Research Program is a fixed-length program to increase Corps capabilities to cost-effectively design and maintain the more than 150 inlet projects that comprise the bulk of coastal operations and maintenance (O&M) expenditures. Because of their complex nature, the behavior of inlets is poorly understood. This has resulted in the Corps spending more of its O&M budget than necessary to maintain inlet projects. The Coastal Inlets Research Program will study functional aspects of inlets such as their short- and long-term behavior and their response to waves, tides, currents, and man-made changes, given their geologic makeup. As inlet behavior becomes better understood, sophisticated tools for management of inlets for navigation projects, such as models and empirical relationships, will become available. These new tools will lead to more efficient, cost effective designs that will reduce O&M requirements and, consequently, costs.

Accomplishments in FY 2005 include:

- Completed R&D and held a tech-transfer workshop (47 attendees) for the Morphology Steering Module in the Surface Modeling System interface, allowing automated coupling of tidal circulation, wave models, and sediment transport. The Morphology Steering Module plays a central role for integrated modeling for field use to calculate tidal circulation, waves (with wave-current interaction), and sediment transport at high resolution. This modeling system allows assessment of jetty modifications, channel infilling, and channel alignment for reduction of dredging and improved navigation safety. Successful evaluations were conducted at Shinnecock Inlet, NY; Grays Harbor, WA; Willapa Bay, WA; Ocean City Inlet, MD; Mouth of Colorado River, TX, and the Matagorda Ship Channel, TX.
- Developed new sediment transport formulas that cover, in continuous fashion, rivers, inlets, nearshore, and offshore zone. Began introducing these formulas into CIRP’s three-dimensional model of channel hydrodynamics and sediment infilling.
- Extended the Reservoir Model for calculating volume change of inlet features such as ebb shoals and flood shoals, and validated the model at East Pass, FL; Ocean City Inlet, MD; and Shinnecock Inlet, NY. This technology allowed predictions to be made in support of Corps navigation projects that previously were beyond capability, accounting for the long-term (order of 100 years) evolution of inlets. Collaborated with the Regional Sediment Management Program in incorporating the Reservoir Model in its coastal modeling technology.
- Developed circulation models for all of the Great Lakes to validate CIRP technology for calculating wind-forced seiching. Collaborated with the Buffalo, Chicago, and Detroit Districts to validate the modeling system for the Great Lakes.
- Developed and verified a numerical model to predict scour for regions characterized by local flow curvature, flow separation, entrainment, and flow interaction with inlet structures. Applied to Matagorda Ship Channel, TX; Ventura Harbor, CA; and

Shinnecock Inlet, NY. Model was released to public through the worldwide web.

- Updated web-based tutorial and handbook on coastal inlets called "Inlets Online" that addresses needs from the professional engineering and science level to college and high school education.
- Developed a neural-network based data-gap filling utility with predictive capability in support of field measurement and long-term simulations of water level and current. Extended the neural network to regional level in an example at Long Island, NY, inlets.
- Supported Corps Districts in addressing concerns on national applicability at specific inlets. These included implementation of a new jetty termination concept at Grays Harbor, WA; sand management prediction at Shinnecock Inlet, NY, for which periodic mining of the flood shoal was demonstrated to be a competitive and favorable alternative for the total inlet sediment system; Ocean City Inlet, MD, involving channel deepening, jetty rehabilitation, and sand bypassing to Assateague Island (National Park Service); and modification of deposition basin design with weir jetty at Mouth of Colorado River, TX.

#### **O&M R&D: Dredging Operations and Environmental Research (DOER) Program**

The DOER Program is an integral and highly beneficial component of the Corps navigation dredging and environmental protection missions. Dredging and disposal must be accomplished within a climate of increased dredging workload, fewer placement sites, environmental constraints, and decreasing fiscal and manpower resources. Balancing environmental protection with critical economic needs while accomplishing dredging activities is a major challenge. The program has validated innovative technologies for high profile contaminants and developed risk based assessments that will significantly reduce testing costs at virtually all harbors. Methods for reclamation and reuse of contaminated sediments from upland disposal areas for beneficial purposes as well as increased capacity are key components of the program that will result in tremendous savings.

Major focus areas of DOER include innovative technologies research, environmental resource

protection, dredged material management, and risk research. Accomplishments in FY 2005 include:

- **Innovative Technologies:** Identified, demonstrated, and evaluated emerging dredging, placement and other technologies such as: Punaise Demo, specialized dredges for contaminated sediment removal, confined disposal facility reclamation, Silent Inspector for cutter suction and dustpan dredges, Dredging Operations Decision Support System and, fluid mud quantification establish navigable depth.
- **Environmental Resource Protection:** Developed effective engineering and construction alternatives to protect environmental resources while allowing dredging operations to proceed in an economically feasible manner. Emphasis was placed on the endangered river sturgeon and salmonid protection, habitat protection from sedimentation and blasting, measures to reduce need for environmental windows.
- **Dredged Material Management:** Developed and validated numerical models, software tools for environmentally and cost effective operations and to address regulatory, habit and beneficial uses of dredged material. Special emphasis was placed on Geographic Information System based dredged material management, dredging and placement site dispersion models, contaminant exposure models for confined disposal areas, and beneficial uses testing, evaluation and database guidance.
- **Risk:** Developed quantitative methods and tools to support risk analysis of the environmental and economic benefits/cost associated with the full range of dredged material management options. Emphasis was placed on; trophic transfer of sediment contaminants, validation of chronic/sublethal bioassays, risk based screening for confined disposal facility contaminant pathways, improved effectiveness of aquatic capping, and treatment technologies for contaminated sediments.

#### **Other Programs**

Within the GI, O&M, and CG appropriations, the ERDC conducts technical support efforts that include



activities such as demonstrations, mapping, data collection and technology transfer.

### Coastal Field Data Collection

The Coastal Field Data Collection (CFDC) Program is nationwide program designed to measure, analyze and assemble information required to accomplish the Corps mission in Coastal navigation and storm damage reduction. It is designed to collect non-project-specific data, i.e. regional data that is necessary for many projects. The Corps' contributes through this program to the Nation's Integrated Ocean Observing System. Major program activities are described below.

Field Wave Gauging and the Wave Information Study provide critical data essential to cost-effective design of Corps' projects.

The Southern California Beach Processes Study (SCBPS) is providing beach processes information specific to West Coast conditions. This information is important for any shore protection, navigation or environmental restoration project in coastal California. This program uses state-of-the-art techniques to examine coastal change and waves along a 100km stretch of southern California that includes 16 Corps projects.

The Pacific Island Land-Ocean Typhoon (PILOT) program is the first major effort to capture wave and water level conditions in the Pacific Basin during typhoons and hurricanes. The Surge Wave Island Modeling System program takes PILOT results and creates a wave and water level prediction system for the Pacific Islands similar to what other models are able to do for the Atlantic and Gulf of Mexico coasts.

The Integrated Ocean Observing System (IOOS) offers great benefits to the Corps. District level participation is not possible due to their funding constraints, so participation in IOOS through the CFDC program makes Corps participation possible.

### FY2005 ACCOMPLISHMENTS

- Completed deepwater wave hindcast for the Pacific Ocean, the first step in providing a 20-yr consistent coastal wave climate data for the Pacific Islands; and put wave hindcast data online for all coasts (except the Great Lakes).
- Completed third year of cross-reef monitoring in Guam and first year in HI. Unique data collected which document wave dissipation over the reef, critical to inundation prediction.
- Under the Southern California Beach Processes Study, provided unprecedented temporal and regional coverage of beach changes which show previously undocumented alongshore variation that is not predicted with existing coastal sediment/evolution models.

### Remote Sensing/Geographic Information System (GIS) Center

The Remote Sensing/GIS Center is the Corps' Center of Expertise for Civil Works Remote Sensing and GIS technologies, providing mission essential support. The Center provides cost-effective support through technology transfer and applications development for Corps mission responsibilities in all business practice areas: navigation, flood and coastal storm damage reduction, hydropower, regulatory, environment, emergency management, recreation, and water supply. Continuing interaction with other researchers and practitioners throughout the Corps, government, the private sector, and academia assures that state-of-the-art and state-of-the-practice knowledge of evolving trends that are important are available for the Corps and that duplication of effort is avoided.

The Center develops approaches for the integration of data from the disparate sources necessary for regional sediment management, basin studies, water control, land and water resource management, support to emergency management, and compliance with the attendant environmental regulations and related policies. The Center maintains cognizance of state-of-the-art sensors, data collection, analysis, and storage systems, commercial software, and bridging software that integrates these and operational technologies into the Corps divisions, districts, and other agencies' activities. Technology is transferred through PROSPECT training program in remote sensing and GIS, workshops and conferences, and Corps publications including Engineering Letters, Circulars, and Manuals.

Accomplishments in FY 2005 include:

- As the Center of Expertise, served as key resource and technology point of contact for the Corps of Engineers for Civil Works remote sensing and GIS.
- Provided guidance and technical support to the Corps' Geospatial Community of Practice (COP) and provided leadership to the remote sensing, hydrology and hydraulics, and emergency sub-COPs.
- Technology transfer through training courses, briefings, technical papers, technical demonstrations, pilot programs, and conferences.
- Initiated development of new PROSPECT course in Image Processing.
- Assisted with review of GIS performance during disasters.
- Provided leadership and technical support to strategic and enterprise USACE geospatial initiatives: Informatics Program Management Team; Common Delivery Format team member; Science and Engineering Technology Tools Program Management Team; Readiness XXI Technology Transfer Program Management Team; Geospatial Operations and Maintenance Business Interlink (gORM) team member; and Hydrology and Hydraulics modeling software development and support team member.
- Participated in the development the Missouri River Program.
- Provided technical support to Corps District offices for the development of implementation plans for Geospatial data management including development of enterprise geospatial data approaches.

**Automated Information Systems Support - Tri-Service Computer Aided Design Drafting/Geographic Information Systems (CADD/GIS) Technology Center**

This effort provides technical support to engineers and scientists utilizing CADD, GIS, and facility management technologies in the planning, design, construction, operation and maintenance of Corps projects. The Center includes participation by the Army, Navy, Air Force to reduce duplication of effort between the three services in the management of CADD/GIS technology for facilities and environmental engineering. In addition the Defense

Logistics Agency, the General Services Administration, USGS, FBI, Smithsonian Institution, National Capital Planning Commission, U.S. Marine Corps, U.S. Coast Guard, National Institute of Building Sciences, NIMA, EPA, and NASA have joined the center. As a result, this Center is a multi-agency vehicle to set standards, coordinate CADD/GIS systems uses, promote system integration, support centralized acquisition, and provide assistance for the installation, training, operation, and maintenance of CADD/GIS systems within the DoD facilities and environmental communities, including the Corps districts. All Corps districts that use CADD and GIS in mapping, planning, real estate, design, construction, operations, maintenance, and homeland defense and readiness benefit from the Center's efforts. Accomplishments in FY 2005 include:

- Release 3.0 of the A/E/C CADD Standard (both document and software tools) was released on CD-ROM and via the web. This released was distributed by several software vendors as part of their application (e.g. ProSoft). Software updates to implementation applications were incorporated in the new release. The A/E/C CADD Standards content was revised to make it compatible with Version 3.0 of the National CADD Standard. Requirements for Building Information Model Standards were developed and incorporated in Release 3.0. Ten on-site implementation training classes were taught across DoD to support user implementations. A web based training course was also developed and made available free of charge to DoD users.
- The GIS Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) Release 2.5 was completed. The SDSFIE included continued development of the GIS data standards for Watersheds, Levees, General Civil Works, Master Planning, Critical Infrastructure, Homeland Security, and Real Estate activities. These activities provide a common data format for the development of GIS on civil works projects, thereby cutting costs and allowing sharing of data sets among government agencies and the private sector. Homeland Security data sets and symbology sets were enhanced in support of USGS and NGA to analyze data more quickly and facilitate data sharing and upward reporting. Electronic tools were developed and enhanced to facilitate the construction of GIS datasets for various GIS

vendor products. Eleven training courses were taught across DoD to support users in the use of GIS data standards. Standards Workgroup Assistance Teams were sent to selected sites to assist the users with implementations.

### **Dredging Operations Technical Support (DOTS) Program**

Maintenance of the nation's navigation projects requires compliance with numerous complex environmental statutes and Presidential Executive Orders. The Dredging Operations Technical Support (DOTS) Program fosters the "one-door-to-the-Corps" concept by providing comprehensive and interdisciplinary technology transfer, technology application, and training essential to all stakeholders involved in Corps navigational dredging projects. DOTS is managed within a centralized program to maximize cost effectiveness and expeditiously implement National policies, laws, and complex technical requirements on a consistent basis. The DOTS Program focuses on application of state-of-the-art technology and research results to field problems. Emerging environmental concerns as well as advances in scientific technology often cause uncertainty in administration of the Corps' navigational dredging program. The DOTS program's technology transfer function provides access to an extensive, up-to-date, consistent technology base and facilitates rapid, proactive responses to technical issues as they emerge. This fosters networking and solutions to common problems confronting the navigation dredging community. Short-term work efforts to address generic Corps-wide technical problems encountered during maintenance of navigable waterways and infrastructure are major features of the DOTS Program. Technology transfer and demonstration of new and emerging techniques with potentially high returns on investment for management of Corps navigation maintenance projects are also important DOTS activities. By disseminating knowledge of new research and development efforts to field offices constrained by staff reductions, the DOTS Program will continue to perform a critical technology transfer role in support of all O&M navigation projects.

Accomplishments in FY 2005 include:

- Numerous technical responses to questions raised by from Federal and state agencies and private concerns dealing with implementation of the inland and ocean

testing manuals, management of confined disposal facilities, protection of sea turtles, and a host of other diverse issues.

- As mandated by the 1972 London Convention, the DOTS program reports ocean dumping activities to the EPA and the International Maritime Organization.
- The program has conducted sediment management seminars since 1991 that have been attended by over 4,800 personnel from Corps districts, federal, state, and local agencies, industry, and environmental protection groups. In 2005 a critical need for training was identified for Corps personnel engaged in navigation projects that involve implementation of the Endangered Species Act, and plans are underway for filling that need in 2006.
- The program also continued to provide specific guidance for the assessment and protection of threatened and endangered species associated with navigation projects. A joint Corps/EPA task force made significant progress toward formulation of a combined, generic ocean and inland disposal implementation manual. This effort fosters consistency in dredged material testing and management between the Clean Water and Marine Protection, Research and Sanctuaries Acts. This type of coordination is promoted through DOTS support of the Center for Contaminated Sediments.
- Expansion, maintenance and updating of several web-based databases provided enhanced access to important sources of information, such as the Environmental Residue and Effects Database (ERED), which continued to be critical for successful implementation of the CE/EPA ocean and inland testing manuals for dredged material disposal. New databases that extend accessibility to related resources, including upland plant toxicology, and tools for risk assessment applications are continually being updated.

### **Inland Waterway Navigation Charts**

This effort provides Corps' Electronic Navigational Chart data for all inland waterways and other federal navigation channels maintained by the Corps to be used by commercial Electronic Chart Systems, which, when combined with the existing Differential Global Positioning System, will improve the safety and efficiency of marine navigation in both

inland and coastal waterways of the United States. On inland waterways, the Corps will collect more accurate survey and mapping data than is currently on its paper charts, and produce Inland Electronic Navigation Charts in accordance with navigation users and vendors. When combined with the commercial chart systems, the Charts will greatly improve the safety and efficiency of navigation. This will allow safe navigation through bridge openings during fog and other bad weather conditions as well as during heavy traffic situations, and provide an accurate display for other systems such as radar and Automatic Identification Systems. The Corps will use the S-57 international data format, which is consistent with electronic chart products produced by the National Oceanic and Atmospheric Administration (NOAA), and the chart products produced by the two agencies will be coordinated for compatibility in adjoining areas. The Corps will also coordinate with the U.S. Coast Guard for aids to navigation information and collaboration rules for chart carriage by waterway users. In coastal and Great Lakes areas, the Corps will produce standardized channel conditions chart products that will provide consistent and reliable information to NOAA for chart updates, in accordance with Water Resources Development Act of 2000, Section 558. Similar channel chart products will be provided to navigation users, and these coastal and Great Lakes channel condition chart products will also follow the S-57 format. Such ENC development and publication activities are in accordance with National Transportation Safety Board recommendations to the Corps, and subsequent commitments made by the Chief of Engineers.

Accomplishments in FY 2005 include:

- New chart development – 1,601 river miles:
- Began or continued development of chart coverage for the Illinois, Cumberland, Lower Tennessee, and Arkansas Rivers; Chart revisions and updates – 2,600 river miles
- Published updated chart cells for the Mississippi, Ohio, Red, and Atchafalaya Rivers.
- Compiled most of the coastal channel Framework.

### Monitoring of Completed Navigation Projects

The Corps operates and maintains more than 800 navigation projects encompassing more than 25,000

miles of waterways. The purpose of this monitoring program is to identify the best navigation project practices and use them to improve all navigation projects' performance. Optimizing projects' performance requires that they be monitored, evaluated against preconstruction projections and present needs, and the lessons learned translated into proactive management guidance for Corps Districts. Information gained from monitoring navigation projects, including changes in sediment transport, water levels, currents, waves, flushing, river flows and other hydraulic phenomena with associated environmental impacts, will be used to verify design expectations, determine benefits, and identify operational and maintenance efficiencies. Information collected from monitored navigation projects can improve projects' performance and optimize opportunities for environmental enhancement. Information collected and analyzed on a national basis documents successful designs, disseminates lessons learned on projects with problems, and provides upgraded field guidance that will help reduce life-cycle costs on a national scale.

Selective and intensive monitoring of Civil Works navigation projects is executed to acquire information to improve project purpose attainment, design procedures, construction methods, and operation and maintenance (O&M) techniques. Both shallow- and deep-draft navigation projects located in rivers, reservoirs, lakes, estuaries, and the coastal zone are included in this program. Projects that will potentially provide maximum life-cycle cost savings are identified and those that best address high-priority cost savings are selected for monitoring and evaluation. Monitoring plans are developed jointly by Corps Districts and the US Army Engineer Research and Development Center. They consist of either a comprehensive detailed survey to verify post-construction conditions on a one-time basis or a repetitive collection of field data. The intensive data are analyzed and the results compared to the pre-construction predictions to verify or upgrade existing design guidance for minimizing O&M cost and assuring project benefits. The analyses include structural, topographic, bathymetric, and hydrodynamic responses and intercomparisons of projects when applicable.

Coordination between the Corps and other Federal, state, and local agencies is essential for proper accomplishment of this program. In addition to satisfying Corps' requirements, the data are made available through publications and will be of value to local, State, and other Federal agencies tasked with the development and implementation of regional

coastal and inland navigation management policies. Results are communicated to member agencies of the Marine Transportation System committees.

Accomplishments in FY 2005 include:

- Published a technical report regarding findings and conclusions of periodic inspections of the Crescent City Harbor, CA, breakwater.
- A periodic inspection of the Cleveland Harbor, OH, east breakwater was completed.
- A technical report providing results of monitoring hydrodynamic, sedimentation, structural, environmental, and geotechnical conditions at Tedious Creek Harbor, MD, was published.
- A technical report providing results of monitoring coastal hydrodynamics, sediment transport, and structural conditions at Aguadilla Bay Harbor, Puerto Rico, was published.
- A technical report was published on monitoring of riverine hydrodynamics and sediment transport processes for minimizing dredging at the upper Mississippi River training structures of Pool 13. Additional critical sites were selected for monitoring in this river region.
- A technical report regarding technology for reducing rubble-mound stone degradation and failure on Great Lakes harbors breakwaters and jetties was published.
- Monitoring of other navigation projects continued, including bendway weirs at the Greenville River Bridge reach of the Mississippi River to determine their navigation, sedimentation, and structural effectiveness. Ship motion data obtained for vessels in existing and improved reaches of the Houston Ship Channel continued to be analyzed and used to validate/enhance ship-to-ship interaction in simulation models.
- Monitoring continued regarding “pocket wave absorbers” used in the Great Lakes to reduce wave action in vertical, parallel-wall harbor entrances and mooring areas.
- Coastal and Hydraulic Engineering Technical Notes were published for each work unit in the MCNP program, thus providing interim results of the monitoring efforts. All monitored projects were previously nominated by Corps field offices for inclusion in this MCNP research program.

### **Regional Sediment Management Demonstration Program**

The Demonstration Program goals are to link the management of authorized Corps projects with one another, particularly across District/Division boundaries, and to leverage data collection and shoreline management activities with other Federal agencies and State and local governments within the limits of a regional watershed system (including uplands, rivers, estuaries and bays, and the coast). The purpose is to demonstrate short and long term cost-savings and increased economic and environmental benefits of maintaining sediments within their regional system, and of using sediments to sustain a balanced environment.

Accomplishments in FY 2005 include:

- New York District compiled sediment-needs assessment for dredging and placement activities by all levels of government and private concerns to define where sediment is currently being moved, and on where and by whom sediment will be needed in the future.
- Characterized the physical and biologic habitats of the Lower Snake River Watershed, to be used in the long-term Programmatic Sediment Management Plan.
- Developed of a Wrightsville Beach to Carolina Beach and Inlet Management Plan (Wilmington District) that will result in a sediment budget for the region.
- Completed a detailed evaluation of fifty existing projects where dredged sediment was used beneficially. The evaluations characterized ecosystem and life-cycle benefits that accrue from effectively managing dredge material placement.

### **Water Operations Technical Support (WOTS)**

Maintaining the environmental and water management conditions at 562 reservoirs (5,500,000 surface acres), 237 navigation locks, 926 harbors, 75 hydropower projects, and 25,000 miles of inland and coastal waterways impacted by the operation of Corps projects requires compliance with numerous statutes and state standards. Providing the technology and knowledge base necessary to address the general non-project specific environmental and

water management needs of project operations can best be accomplished through a comprehensive centralized program that will maximize cost effectiveness, and ensure broad dissemination and implementation of technology and information.

Accomplishments in FY 2005 include:

- The program annually publishes and distributes numerous copies of manuals, bulletins, notes, and reports. WOTS annually conducts specialty workshops, training personnel on the latest environmental and water quality management techniques.
- The WOTS program successfully responded to 50 direct technical assistance requests from 26 Corps Districts, conducted 3 technology demonstration efforts to verify management strategies and techniques, conducted 6 training workshops on environmental and water quality management techniques, and prepared 7 technical publications for distribution to the field.
- A continual endeavor of the WOTS program is coordination with water quality and environmental elements of other Federal agencies such as the Environmental Protection Agency, Tennessee Valley Authority, Bureau of Reclamation, Fish and Wildlife Service, U.S. Geological Survey, and the Bonneville Power Administration. These efforts have involved watershed management activities, problems related to the introduction and spread of aquatic invasive species, environmental impacts of hydropower facilities, and impacts of water releases in tailwater areas on fisheries.

### Scientific and Technical Information Centers

Five information analysis centers located at the ERDC provide the major interface between the Corps of Engineers and the public and private sectors to gather and disseminate information as required by PL 99-802, Federal Technology Transfer Act of 1986. The function of each center is to acquire, examine, evaluate, summarize, and disseminate newly published scientific and technical information generated within the Corp of Engineers and other activities in the U.S. and abroad.

The Coastal Engineering Information Analysis Center focuses on wave data and predictions, shore processes, inlet dynamics, navigation channels and structures, harbors, and coastal construction. The Cold Regions Engineering Information Analysis Center focuses on ice engineering, meteorology, climatology, geophysics, geology, remote sensing, and environmental engineering. The Concrete Technology Information Analysis Center focuses on cements, concrete, aggregates, concrete construction, concrete repair and rehabilitation technology. The Hydraulic Engineering Information Analysis Center focuses on hydraulic, hydrologic, water resources, and sedimentation of streams, rivers, waterways, reservoirs and natural impoundments; estuaries, inland and coastal groundwater; fishery systems; and hydraulic structures of all types. The Soil Mechanics Information Analysis Center focuses on embankment and foundation engineering, earthquake engineering, engineering geology, and rock mechanics.

The information centers critically evaluate and summarize the technical validity and merits of published and unpublished research and technical publications on design, construction, or other technology utilization. User communities have been well established and distribution lists for technology transfer are continuously updated. Electronic media including the World Wide Web are used where appropriate. The effectiveness of activities and services is evaluated on a continuing basis, and technology transfer products and methodology are revised when appropriate.

### CUSTOMER SUPPORT

Increasingly, ERDC expertise and products developed in R&D programs are being requested to solve challenges in critical areas of concern. Following are a few examples of the many projects the ERDC conducts for its many customers.

**Direct Technical Support to Corps of Engineer Districts in the areas of Wetlands and Watershed assessment.** ERDC scientists receive reimbursable support to provide technical assistance on wetland delineation and watershed management directly to various Corps of Engineers Districts. Examples of this include the following projects performed cooperatively with the St. Paul, Buffalo and San Francisco Districts. In the Minneapolis-St. Paul area the COE District was confronted with difficult questions involving wetland delineation in an area of historic hydrologic modification. ERDC wetland

soil specialists and hydrologic modelers teamed to evaluate the area and provide sound technical advice on soil permeability, the impact of ditching on hydrology and wetland identification. Buffalo District has named an ERDC scientist as a virtual team member and “technical lead” in their effort to develop a comprehensive watershed management plan for the Onondaga Lake watershed near Syracuse, New York. In another watershed management project, ERDC is developing a watershed assessment tool which utilizes a knowledge-based development system, a decision support system, and GIS to organize and apply the most current geomorphological and ecological principles to watershed assessment. This project is being supported by the San Francisco and their cooperators in the Russian River Basin.

**Invasive Plant Control (NH).** The submersed invasive plant, variable milfoil is rapidly infesting water bodies in New Hampshire, degrading water quality, fish and wildlife habitat, recreational opportunities, and property values. Through an intergovernmental cooperative agreement with the state, the US Army Engineer Research and Development Center is developing specific strategies for aquatic herbicide use that incorporates target and non-target plant phenology, water quality, and dose and timing of treatments. Results from this effort will provide guidance for selective, optimal, and cost-effective control of variable milfoil in New Hampshire and the New England region.

**Inner Harbor Navigational Canal (IHNC) Lock Replacement and Coastal Marsh Restoration (LA).** The IHNC project was undertaken so that the IHNC lock can be replaced with a larger, modern lock. The current lock, completed in 1923, is too small to accommodate existing traffic, causing traffic delays. Construction of the IHNC lock will require dredging of 3 million CY of sediment; however, this sediment is contaminated due to industrial activity. Dredged material from the project will be placed in the Mississippi River, a confined disposal facility, or be used beneficially for construction backfill and marsh restoration. This ongoing project is currently under litigation. The US Army Engineer Research and Development Center (ERDC) is providing direct support to the US Army Engineer District, New Orleans, for litigation expertise, risk-based contaminant evaluations, and environmental engineering. Specific activities being performed by ERDC include sampling plan development, aquatic toxicity assessment, terrestrial bioaccumulation studies, fate and transport modeling, and risk-based

modeling and assessment. Dredged material that is categorized as posing no unacceptable adverse impacts on humans and ecological systems will be used for marsh/coastal restoration.

**Fish Passage for Snake and Columbia River Dams.** Corps of Engineers dams on the Snake and Columbia Rivers can injure or kill outmigrating juvenile salmon (migrants) as they migrate from their natal streams to adult habitat in the ocean. Large, complex bypass systems are typically employed to divert migrants away from powerhouse turbine intakes during this migration and pass them safely to downstream areas. However, to be effective, bypass systems must create approach and interior hydraulic conditions that attract migrants and cause them to avoid all other possible dam exits. Researchers decoded the “traffic rules” used by migrants to navigate complex flow fields using advanced, integrated engineering-biological modeling methods developed at the US Army Engineer Research and Development Center. This understanding was then implemented in a “plug and play” tool – the Numerical Fish Surrogate (NFS) - to evaluate the performance of alternative bypass systems during project design instead of during post-project monitoring. The NFS will shorten project cycle time with attendant economic benefits and reduce impact on this valuable living resource.

**The Regional Internet Bank Information Tracking System (RIBITS)** The COE Regulatory District Offices manage multi-agency Mitigation Bank Review Teams (MBRTs) tasked with the formulation of District guidance for prospective mitigation bankers and potential bank users. Representative agencies include the Environmental Protection Agency, the Natural Resource Conservation Service, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and various key state agencies. The Regional Internet Bank Information Tracking System (RIBITS) was developed by the ERDC to manage Mobile District’s mitigation banks, support the District’s MBRT, and serve as a source of technology transfer for prospective mitigation bank developers and customers owning impact sites. RIBITS allows the District to track the status of mitigation banks, monitor credits and debits incurred by permitting actions, view compliance reports, and automatically email requests for information and upcoming deadlines from a single Internet-based interface. RIBITS was designed as an underlying SQL database that stores information on existing mitigation banks,

users, habitats, watersheds, credit ledgers, and ecological progress. The Website is partitioned into public and restricted access components. The public access component provides information on mitigation concepts, bank establishment guidance, assessment tools, habitat classification, and highlights existing mitigation banks. The restricted access component of RIBITS allows individual mitigation bank managers to monitor their bank's credit ledger and ecological progress and provides access to supporting documentation (i.e. banking instruments, monitoring reports, etc). The MBRT and the District's Regulatory Branch can track each bank's credit ledger, monitor ecological progress, schedule site visits, and summarize available and sold credits across the District.



# INSTITUTE FOR WATER RESOURCES

## BACKGROUND

The U.S. Army Institute for Water Resources (IWR) is a field operating activity under the staff supervision of the Director for Civil Works, Headquarters, U.S. Army Corps of Engineers (HQUSACE). The Institute is the USACE center of expertise for integrated water resources management (IWRM), focusing on planning analysis and hydrologic engineering, and on the collection, management and dissemination of civil works and navigation information, including the Nation's waterborne commerce data.

The Subcommittees on Public Works, House and Senate Appropriations Committees, authorized the establishment of IWR in 1969 to facilitate the adaptation of the Civil Works Program to future needs by providing the USACE with the capability for developing forward-looking analysis and state-of-the-art methodologies. The Institute's mission is to support the Civil Works Directorate and the USACE MSC's and District offices by providing: (a) analysis of emerging water resources trends and issues; (b) state-of-the-art planning & hydrologic engineering methods, models and training; and, (c) national data management and results-oriented program and project information.

## IWR CENTERS

IWR has offices at three locations, each of which is a designated USACE center of expertise (DX): the National Capital Region (NCR) office in the Casey Building at the Humphreys Engineer Center, Alexandria, Virginia; the Hydrologic Engineering Center (HEC) in Davis, California; and the Waterborne Commerce Statistics Center (WCSC), which is part of the NCR's Navigation Data Center (NDC), in New Orleans, Louisiana.

**National Capital Region Office:** The IWR NCR office is the Corps DX for the development of planning methods and analytical tools. IWR fulfills this mission through a synergy of water resources planning and socio-economic expertise that blends practice with research, policy development and information. IWR planners, economists, social scientists, civil engineers and specialists in the physical sciences lead civil works strategic, planning and technology transfer initiatives; conduct national and focused policy development

studies; develop a broad range of partnering and investment decision-support techniques, methods and models for IWRM and navigation system applications; provide national and international interface with the water resources community at-large; and partner with the HQUSACE, Corps field offices and laboratories in solving complex technical water resources planning and evaluation problems. In particular, the Institute provides a critical mass of socio-economic expertise within the Corps, and serves as the residence for the Corps Chief Economist position which provides leadership of the Economics Community of Practice (CoP).

**Hydrologic Engineering Center (HEC):** The primary goal of HEC from its creation in 1965 is to support the Nation in its water resources management responsibilities by increasing the Corps technical capability in hydrologic engineering and water resources planning and management. An additional goal is to provide leadership in improving the state-of-the-art in hydrologic engineering and analytical methods for water resources planning. By means of programs in research, training, planning analysis, and technical assistance, efforts are made to be aware of the problems and needs of the Corps and the Nation. A commitment is also made to keep abreast of the latest developments throughout the water resources engineering profession, and to make use of this information in a manner best suited to the needs of the USACE. HEC increases the effectiveness of the Corps and the profession by bridging the gap between the academic community, practicing hydrologic engineers, and planning professionals. HEC incorporates state-of-the-art procedures and techniques into manuals and comprehensive computer programs. The procedures are made available to the Corps, United States and international professionals through an effective technology transfer system of technical assistance, publications, video tapes, and training. Technical specialty areas addressed by HEC include: Precipitation-runoff processes, reservoir systems analysis, hydrologic probability and risk analysis, river hydraulics and sediment transport, groundwater hydrology, water quality, and analytical aspects of water resources planning. Application areas include: Flood damage reduction, water control management, hydroelectric power, navigation, erosion control, water supply, watershed studies, and ecosystems restoration.

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**Navigation Data Center:** NDC is the Corps DX for the management of information on infrastructure, utilization and performance of U.S. waterways and port and harbor channels. Because of the integrated nature of water resources, NDC also directly supports a range of related CW business areas, including: hydropower, recreation, environmental compliance, natural resources, regulatory, emergency preparedness and readiness; along with other Federal, state, local agencies; plus the private sector. The primary operational arm of NDC is Waterborne Commerce Statistics Center (WCSC), which provides one-stop capability for national navigation information systems. NDC also provides integrated business information in support of Corps decision making to include financial, output, and performance measurements.

### FY 2005 SUMMARY

FY 05 was a remarkably productive year for the Institute during one of the most challenging periods in its 36-year history. During FY05 IWR executed a Civil Works Program of \$29 million with 154 in-house employees, primarily in professional disciplines with most possessing advanced degrees. IWR's in-house staff was supplemented by other experts detailed from USACE field offices and laboratories; Intergovernmental Personal Act (IPA) visiting scholars from universities and policy think tanks; and the private sector.

FY05 proved especially rewarding as it represented the first full year of operations under the Institute's "new" internal organizational structure in alignment with USACE 2012. Under this concept with the IWR management paradigm is based on a matrix team approach in-lieu-of a traditional function-based, stove-piped organization. IWR's new structure was approved in July 2004 upon issue of its updated Organization and Functions Statement, Engineering Regulation (ER) 10-1-23.

IWR's key accomplishments in FY05 include its technical role in supporting the USACE-wide implementation of the Civil Works Strategic Plan (IWR had previously led the completion of the plan in FY04); the continued publishing of new research products on maritime transportation economics flowing from the Navigation Economic Technologies (NETS) Research Program; the completion of all technical studies in support of the Lake Ontario and St. Lawrence River Project for the International Joint Commission (IJC); fielding new versions of HEC's flagship NexGen software products; issuing new versions of the Corps

Water Management System (CWMS) and the Civil Works Program's Operations and Maintenance Business Information Link (OMBIL), including significant progress on the deployment of OMBIL's Regulatory program module (ORM); initiating (pre-Katrina) a national flood risk initiative aimed at addressing residual flood risk at areas protected by levees; continuing progress building federal interagency partnerships with the Department of Interior (Bureau of Reclamation and U.S. Geological Survey), Department of Energy (Oak Ridge National Laboratories and Sandia National Laboratories), Department of Agriculture (Economic Research Service and the Natural Resources Conservation Service), and the Federal Emergency Management Agency; and executing a wide number of technical assistance projects, including a growing number of significant technical activities in the international arena such as for the U.S. Agency for International Development (USAID) in support of the Iraqi Ministry of Water Resources.

As FY05 came to a close, the Institute was in the formative stages of initiating an unprecedented array of technical initiatives involving both IWR NCR and HEC in support of the USACE response to/and the post-event analysis of Hurricanes Katrina and Wilma. At the same time, IWR was proceeding through its own disaster recovery and mission reconstitution process for the Waterborne Commerce Statistics Center (WCSC) which is co-located at the New Orleans District (CEMVN) and was likewise victimized by Hurricane Katrina. All of WCSC's 39 people (and 15 resident contractor staff) safely evacuated from greater New Orleans the weekend prior to the landing of Hurricane Katrina; however, approximately half of the WCSC staff ultimately suffered devastating personal losses to their homes and property.

The accomplishments of IWR during FY05 are described in accord with its major focus areas.

### STRATEGIC THINKING

**Future Directions:** The major activities included supporting implementation of the Fiscal Year 2004-09 Civil Works Strategic Plan published in FY 2004, participating in development of the next strategic plan through research and scenario development, and developing policy responses to new challenges, including the need for unified flood risk management. The release of the CW Strategic Plan in 2004 represented the culmination of a multi-year effort aimed at establishing a new direction for the Civil Works

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Program based on the contemporary “watershed” planning approach of Integrated Water Resources Management (IWRM). The plan’s five strategic goals are firmly grounded in the “systems” perspective of IWRM and are fully aligned with the principle of environmental sustainability.

**Emerging Issues:** Although the Institute anticipated questions about the adequacy of the Nation’s flood and storm damage protection infrastructure, the urgency of responding to Hurricane Katrina reoriented IWR’s FY05 policy development program. Just prior to Hurricane Katrina the Institute prepared five issue papers regarding the nation’s preparedness for floods and hurricanes and held a provocation session on flood risk for Corps Senior leaders. Subsequently, IWR scoped a unified flood risk management policy paper based on lessons from Katrina and ongoing case studies of California flood management.

After Katrina struck, the Chief of Engineers demanded answers to questions about the performance of the New Orleans Hurricane Protection System. To answer these questions, the USACE established the Interagency Performance Evaluation Task Force (IPET). IWR was designated co-lead of the consequences assessment and interior flood control (IFC) sub-teams. The former team was charged with measuring the economic, human health, social, and environmental consequences of Katrina, while the IFC team undertook an in-depth evaluation of New Orleans interior flood systems. In addition to IPET, the HQUSACE anticipated that there would be questions about the decisions that lead to the design and construction of New Orleans Hurricane Protection System. In response to this challenge, IWR organized a Hurricane Protection Decision Chronology (HPDC) team that will report findings after IPET activities are completed in 2006.

**Post Katrina Studies:** The planning for what became the Interagency Performance Evaluation Task Force (IPET) was initiated at the end of FY05 following the devastating effects of hurricane Katrina. IWR staff participated in developing the plan of study for IPET helping to organize the overall study within a risk analysis framework. Additionally, IWR provided logistics and support for the IPET study development task force. IPET work was started at the beginning of FY06. The IPET study is comprised ten interrelated tasks involving over 150 experts from USACE, other Federal agencies, local agencies, academics and contractors.

In FY05, IWR developed the plan of study, formed the study team and initiated what became the Hurricane Protection Decision Chronology (HPDC) study and team. HPDC was established at the direction of HQUSACE. It is acting as a complement to IPET by assembling and documenting the chronological record of planning, economic, policy, legislative, institutional, and financial decisions that influenced the design, scale, configuration, and condition of the greater New Orleans hurricane protection system. The team is composed of external experts on water resources policy and planning, non-Federal flood and storm water protection, and in-house staff under the overall direction of IWR.

**USACE Chief Economist:** Dr. David Moser of IWR is the USACE Chief Economist and leader of the Economics Sub-Community of Practice (Cop). FY05 activities included the organization of senior economists group which includes senior economists from each MSC’s, HQUSACE and IWR. This group held two meeting during FY05 with the primary goal of improving economic analysis capability within USACE. To that end, the senior economists group developed a subject matter expert database of all economists in USACE which includes assessment of the experience and expertise of each economist for each economic activities conducted by USACE. Additionally a listing of core competencies by project purpose was developed providing the major activities and skills necessary to complete those activities. The group is working on developing a “gap” analysis to identify needed skills and capabilities. Work proceeded on the update of water resources planning National Economic Development (NED) Manuals (a NED Overview Manual and updated guidelines on flood damage reduction and deep draft navigation). Activities also included the design of a career path template for Corps economists, and the scoping of future work on defining competence standards and training programs. The USACE Chief Economist participated in selection boards for senior economists throughout the Corps, and in the conduct of Independent Technical Reviews (ITRs) on the economics component of a complex navigation project. The USACE Chief Economist was involved in issues relating to NED evaluation of externalities and value of time saved.

**National Shoreline Management Study:** The National Shoreline Management Study (NSMS) is a collaborative, interagency effort to determine the extent and cause of shoreline erosion along the coasts of the U.S. The NSMS is also assessing the national level economic and environmental impacts of such erosion, and is examining the appropriate Federal and non-

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Federal roles and policies in shore protection activities. The five study workgroups are co-chaired by a mix of Corps and other Federal agency representatives. From a technical and policy standpoint, the NSMS is also assessing the use of subsystems approaches to management sediment holistically (Regional Sediment Management or RSM) in close coordination with related USACE and other intergovernmental activities, including the RSM demonstration projects being conducted by Corps districts and the ongoing coastal research of the Coastal-Hydraulics Laboratory (CHL). In FY 2005, the Shore Processes Work Group commenced development of a conceptual study, using the Gulf Coast that will describe the general level of detail and type of data available to be used by the other Work Groups to examine the economic and environmental implications of shore erosion and accretion.

**Policy Development:** The Institute conducted a range of policy development studies in 2005. The Nature of Policy Studies and Water Supply Database 2005 Update were initiated. Examples of completed studies include: Water Supply Database 2004 Survey; the Survey & Analysis of Criticisms of Corps Planning Guidance (the Principles and Guidelines) & Links to Planning Studies (the P&G); and a Regulatory Impact Analysis for Proposed Compensatory Mitigation Rule; and Achieving Environmental Sustainability. The Institute also conducted a Civil Works “provocation” session with the HQUSACE outgoing and incoming leadership on selected water resources issues and future challenges, including an in-depth discussion of the implications to the future CW Program.

### COLLABORATION AND PARTNERING

**Environmental Advisory Board:** The Institute assumed a lead technical role in supporting the Chief’s Environmental Advisory Board (EAB, a Federal Advisory Group) beginning in FY04. In this role the Institute leads a team of specialists drawn from throughout the Corps in partnership with ERDC to advise and assist the EAB as it reviews the Corps Civil Works missions, roles and business processes. Technical support in 2005 focused on seven themes, which the Chief requested EAB review and provide recommendations: (1) the adequacy of legislative authorities for Corps ecosystem restoration; (2) the Corps application of adaptive management principles in ecosystem restoration; (3) creating an environment for improving the Corps Outreach and Partnering; (4) improving the Corps Regulatory Program; (5) alternative frameworks for determining environmental benefits, (6) methods for measuring environmental

restoration project performance, and (7) the success of peer review processes implemented by the Corps.

**Inland Waterways Users Board:** The Institute continued its support of the Inland Waterways Users Board (IWUB) in FY05, including the analysis of and reporting on the financial status and capability of the Inland Waterway Trust Fund (IWTF) at meetings of the Board, and the administration of three IWUB meetings including No. 47 on December 7th, 2004, in St. Louis MO, No. 48 on February 24<sup>th</sup>, 2005, in Washington, DC, and No 49 on July 27<sup>th</sup>, 2005, in St. Paul, MN.

**National Outreach:** IWR’s FY05 technical interface activities included collaborations with a wide range of national research, professional, industry and non-governmental organizations, including: National Research Council’s Water Science and Technology Board, the Transportation Research Board, and the Marine Board; the American Society of Civil Engineers (ASCE) Environmental and Water Resources Institute (EWRI) and Coasts, Oceans, Ports and Rivers Institute (COPRI); the American Water Resources Association (AWRA); and the American Association of Port Authorities (AAPA), to name just a few.

IWR also had a very active role supporting the AWRA in the Second National Water Resources Policy Dialogue, February 14-15, 2005, which provided a forum for participants from all levels of government, as well as public and private organizations, to discuss critical water resources challenges facing the nation.

**The Nature Conservancy Sustainable Rivers Project:** Launched in July 2002, the Sustainable Rivers Project (SRP) is a nation-wide partnership between the U.S. Army Corps of Engineers and The Nature Conservancy to improve the integrity and life of rivers by changing the operations of Corps dams. The SRP is working towards this goal through a combination of partnered activities, including demonstration projects, training, software development, and a staff exchange that assigned an engineer from the Corps’ Hydrologic Engineering Center to Sustainable Rivers through an IPA (Intergovernmental Personnel Act). The exchange was signed as a one year agreement and later extended for a second year, which concluded in February 2006. It was instrumental in promoting the partnership, providing direct support to project sites (especially for the Savannah, Green, West, Ashuelot, and Bill Williams Rivers), and initiating a joint software development project and a joint training program, which has now graduated students from nearly 90% of Corps Districts. Many lessons learned from the direct project support have now been

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incorporated as material in the joint training courses. After conclusion of the personnel agreement, HEC has stayed active in Sustainable Rivers and the broader Corps-Conservancy partnership and is looking for ways to continue and build on these efforts in the future.

**Flood Risk Management Initiative:** Collaboration with FEMA, other Federal agencies, state and local governments, and important associations like NAFSMA and ASFPM is critical to the development of a sound national flood risk management strategy. Minimizing institutional barriers to efficient and effective water resources planning, decision making, and management, is defined by the Civil Works Strategic Plan as one of the five challenges affecting the nation water resources. To effectively address this challenge, institutional barriers must be broken down both between and within individual agencies. Flood risk management in the U.S. today presents a stark example of a water resource issue where minimization of institutional barriers through collaboration is essential to ensuring the safety of our citizens. The Institute of Water Resources has been instrumental in developing collaborative partnerships to improve the management of flood risks across the nation.

The basic framework for collaborative partnerships in flood risk management has been created through the Levee Policy Committee of the FEMA Map Modernization Program, the quarterly FEMA-Corps-NAFSMA-ASFPM Senior Leaders meetings on flood risk management, previously long-standing relationships between the Corps and NAFSMA through the Corps Flood Damage Reduction Program and, to a lesser extent, Memorandums of Understanding with FEMA, the Bureau of Reclamation, USGS and NRCS.

Over the last two years the Institute has provided intellectual leadership of both the Levee Policy Committee and the FEMA-Corps-NAFSMA-ASFPM senior leader meetings. The Levee Policy committee includes representatives from all Federal water resource agencies as well as state agencies and organizations such as NAFSMA, ASFPM and insurance companies with an establish goal of articulating levee policy for the FEMA Map Modernization Program. Similar to the Levee Policy Committee, the FEMA-Corps-NAFSMA-ASFPM senior leader meetings were initiated in August 2005 to discuss flood risk coordination issues, again, primarily related to the Map Modernization program.

In order to improve partnering at the state and regional level, the Institute worked in cooperation with the Federal Emergency Management Agency to establish an initiative called “Silver Jackets”. The concept focuses on USACE and FEMA partnering with State

agencies as lead facilitators in establishing an interagency team with each state. The purpose of these teams is to work collaboratively with the State and appropriate stakeholders in developing and implementing solutions to natural hazards by combining available agency resources, which include funding, programs, and technical expertise. Each team’s membership and goals will be geared toward that particular state.

An interagency team, the Silver Jackets, was implemented in a pilot state – the State of Ohio. Core team members include USACE, FEMA, USGS, NRCS, HUD, EDA, NWS, Ohio Division of Natural Resources (ODNR), Ohio Emergency Management Agency (OEMA), and Ohio EPA. The State of Ohio, hesitant at first, now fully supports the team - demonstrated most recently by the State submitting this team as a program that should be supported by local congressional interests. An additional team has recently been established in the State of California. Nineteen different Federal and state agencies attended the initial meeting conducted in July 2005, demonstrating the interest and support of this concept.

**IWR Visiting Scholar Programs:** FY05 marked the fourth year for the Institute’s Maass-White Visiting Scholar program, established in 2001 in recognition of the contributions of, and the Institute’s intellectual alignment with, two of the founders of modern water resources analytical theory – Professors Arthur Maass, Harvard University and Gilbert White, the University of Chicago. FY 2005 also was the second year for two other designated visiting scholar positions: one in partnership with the Universities Council on Water Resources (UCOWR), and HEC’s Roy Beard Visiting Scholar program – named after the founding director of HEC. Each of these programs seek to bring the foremost water resources experts from academia, private industry, and other agencies and laboratories to residence at IWR or HEC for periods of six months to one year. Visiting scholars are expected to help infuse new energy and ideas to the IWR program, while the practical work environment at IWR/HEC provides a stimulating context for mutual exploration of potential advances in hydrologic engineering and planning analysis.

IWR’s Maass-White Scholars have included Dr. Daniel (Pete) Loucks, Cornell University (2001-2002), Dr. Peter Rogers, Harvard University (2002-2003) and Dr. Leonard Shabman, Resources for the Future, (2003-2005), while the inaugural UCOWR Fellow was Dr. Bruce Hooper, Southern Illinois University (2004-2005), who worked on performance indicators for successful watershed-based organizations. HEC’s first

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Roy Beard visiting scholar was Mr. Tony Thomas, founder and president of Mobile Boundary Hydraulics, followed by Dr. Jerry Stedinger, Cornell University (2005).

In FY05, IWR had other visiting scholars, including former U.S. Army Brigadier General Dr. Gerald Galloway, now a University of Maryland professor. Still a visiting scholar at IWR, Dr. Galloway is presently very active in the post-Katrina water resources policy discussion on the national scene.

### WATER RESOURCES METHODS AND MODELS

**Planning Models Improvement Program:** In 2004 HQUSACE Director of Civil Works approved the recommendations of the Planning Model Improvement Program (PMIP) Task Force, which was co-directed by IWR. Key HQUSACE commitments included publishing guidance in 2005 that prescribes a corporate business process and policy for the development, certification, training and on-going support for planning models, with the certification process based on internal and external peer support and review, and with the responsibility for establishing priorities and managing the certification process residing with the planning centers of Expertise, in coordination with the findings of Strategic Engineering and Technology (SET) Initiative. This policy ultimately manifested in 2005 as Engineering Circular (EC) 1105-2-407. Also key to PMIP recommendations was the coincidence with the peer review protocols being used as part of the NETS research program for navigation analysis models. In FY 05, IWR with input from other Corps laboratories and the Planning Centers of Expertise developed protocols for model certification, which includes the processes and criteria to be used for certifying planning models. The protocols are being tested on three planning models and the results will be used to finalize and publish the protocols for certification. The tests are led by IWR with the participation of the Planning Centers of Expertise.

**Navigation Economic Technologies Research:** For more than a century the U.S. Army Corps of Engineers has played a key role in maintaining a robust national economy by ensuring that farmers, manufacturers and businesses can easily transport goods up and down our nation's rivers and out to sea via coastal ports. The Navigation Economic Technologies (NETS) Research Program supports the navigation mission by developing state-of-the-art, credible, independently verified economic models, tools and techniques to be used by USACE field planners in informing investment decision-making at all levels of the agency.

To ensure that our nation's navigation system remains as efficient, effective and affordable as possible, the NETS research is aimed at developing a standardized and transparent knowledge base and associated suite of economic evaluation tools for addressing these issues. Key focus areas include: analyzing shipper behavior and responses, particularly decisions to switch to non-water modes of transportation, and assessing global market conditions, including the impact of international competition and commodity flows.

The NETS research program has two primary focal points: expansion of the body of knowledge regarding the economics underlying use of waterways and harbors, and creation of an economic decision-support toolbox of practical planning models, methods and techniques that can be applied to a variety of situations. The knowledge and tools developed by the NETS research program are based on: reviews of economic transportation and market theory; current best practices both within and outside of the Corps; data needs and availability; and peer recommendations.

In FY05, NETS research continued development of a series of practical tools and techniques for use by Corps navigation planners across the country. The centerpiece of these was a suite of simulation models that include:

- The Global Grain forecasting model. This effort demonstrates a spatial equilibrium forecasting technique that can be used in a variety of settings. As developed, it focuses on the global grain trade with a specific emphasis on Mississippi river grain flows. This model is being modified to respond to independent peer review comments.
- The Mid-America Grain study, conducted in FY04, estimated the shipper response curve for the shippers who use the Upper Mississippi. These findings have been incorporated into a new annual model. This "Survey Model" is designed to respond to the criticisms made by the Nation Academy of Science to the structure and inputs of previous models. The Survey Model is being prepared for certification by the PCX for inland navigation.
- The survey techniques and shipper response econometric techniques that were developed for the Mid-America study where sharpened and applied to shippers utilizing the Columbia

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River. This is the second demonstration of the ability to estimate shipper response.

- The Oak Ridge National Laboratory has started work on the Regional Routing Model. This traffic routing model will identify annual quantities of commodities from various origins and routes used to satisfy forecasted demand at each destination.
- Significant advances were made to two microscopic event models. The beta version of the HarborSym model was released, and DDPCX-sponsored training has been delivered. The model, training material and user's guide are all available on the NETS web site. The Navigation System Simulation (NaSS) model reached its first milestone with the publication of the draft design document. This document is being revised to respond to independent peer review comments.
- Model communications have been enhanced with the development of animation and visualization tools. For the inland waterways, the Inland Navigation Animation Module (INAM) will allow for the visualization of LPMS data and, in the future, Navigation System Simulation analysis. The HarborSym Animation Model (HSAM) animates HarborSym analysis. These features greatly facilitate model calibration and communications.
- Work has begun to incorporate NETS research findings into legacy models. In conjunction with the Oak Ridge National Laboratory, NETS is working to incorporate "shipper response" into the Ohio River Navigation Investment Model (ORNIM). This effort will remove from the model the need for perfectly inelastic demand curves. In a related effort, NETS is working with the PCX for inland navigation to conduct surveys to estimate the shape of the shipper response curves on the Ohio River. These inputs will be needed for the modified version of ORNIM.

Looking forward to 2006, NETS is transitioning from research to practice. However, many areas of research remain. The HarborSym channel-widening model is now being used in field study, while the NETS team extends its functionality to include channel-deepening analysis. We will conduct shipper response surveys on the Ohio, and again on the Upper Mississippi, while incorporating shipper response into

the Survey Model for use by the Upper Mississippi study team. The NETS team will further develop the spatial equilibrium-forecasting tool, while the Upper Mississippi study team adopts the Global Grain application for study use. Continued development of the Regional Routing Model and the Navigation System Simulation Model will produce prototypes in FY06. The NETS team continues to focus on outreach and communications with the NETS web site, NETS Newsletter and participation at conferences around the world.

**Cost Effectiveness and Incremental Cost Analysis:** The Institute deployed an updated version of IWR-PLAN (Version 3.33), which is a water resources investment decision-support tool that performs cost-effectiveness and incremental cost (CE/IC) analyses associated with the formulation and evaluation of planning alternatives which produce non-monetary or a combination of monetary and non-monetary outputs. Developed in partnership with the Social Sciences Institute and the Department of Interior's Natural Resources Conservation Service (NRCS), IWR-PLAN was originally designed to assist with the development and comparison of alternative plans for ecosystem restoration and watershed planning studies. However, the program can now be applied to a wide variety of integrated water resources planning and management (IWRM) problems by helping identify which plans are the best financial investments by displaying and comparing the effects of each plan on a range of decision variables.

**Transportation Systems:** IWR's Transportation Systems program supports Corps districts and HQUSACE in accomplishing navigation project planning and valuation responsibilities through the provision of uniform, consistent maritime transportation data on the operation and replacement of commercial waterborne vessels and comprehensive statistics on the composition of the world deep draft fleet and world trade and cargo flow forecasts. Accomplishments for FY 05 include, updated vessel fuel costs; world trade and commodity flow forecasts; update and distribution of materials from various subscriptions; update of the Inland Waterway Review, including cargo trends and lock and dam operations and investments throughout the inland navigation system, and updated barge, rail and truck alternative transportation modal models.

**Flood Damage Data:** The Institute's Flood Damage Data program provides a centralized, consistent and cost-effective database of depth damage data for use by all USACE district planners. The Program's main objective is to conduct and consolidate actual flood damage surveys following flood events for both coastal

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and riverine events. Accomplishments in FY05 included the design, testing and release of updated OMB approved questionnaires for the field conduct of flood damage surveys, the development of generic business depth damage relationships, and the collection of data and development of a model for estimating damages to roads.

**National Economic Development Manuals:** In FY05, IWR continued the development of revised National Economic Development Manuals for flood damage reduction, deep draft navigation and storm damage prevention (coastal). The manuals provide a description of procedures and tools for use in the economic evaluation of water resources projects and are an invaluable tool for Corps economists and planners. A draft of the flood damage reduction manual was completed in FY 05 and is under review by field planners. A main component of this effort is the publication of the manuals as web-based tools. The development of a prototype of the web-based manual was initiated in FY 05.

**System-Wide Water Resources Research:** FY 2005 was marked by a major joint effort of IWR, led by HEC, with the Engineer Research and Development Center (ERDC) laboratories in shaping the new System Wide research and development program, a program focused on expanding the view of research activities to the 'System Wide' perspective, reflecting a concerted effort by USACE to better work consistent with concepts of sustainable development in a watershed context. The effort has thus far been most successful, portending the development of new and exciting products for field office use in the coming years. It should be noted that most of the IWR software and new methods development is funded from this and other USACE civil works research programs.

**NexGen Software:** HEC-HMS version 3.0 was released in early 2006. This release constitutes a major update to HMS. There are many new features as well as a completely new user interface that provides newly designed functionality. Besides replacing the proprietary user interface, new technical features include automated frequency curve development, the addition of snowmelt capability, and incorporation of interior flooding simulation capability. The companion GIS utility package (HEC-GeoHMS) is being updated and new features added to prepare for a parallel release with the new HMS version. This utility provides substantial capability to effectively use national terrain data sets to rapidly develop HEC-HMS models.

At the end of fiscal year FY04, final touches were being put on HEC-RAS (Version 3.1.3) for release in May 2005. Work on adding sediment transport began in FY05 and a release with sediment capabilities is slated for FY06. The companion GIS utility package (HEC-GeoRAS) has also undergone improvements and was released simultaneously with HEC-RAS Version 3.1.3.

The major flood damage and risk analysis software package, HEC-FDA, continues to be improved, with progress made in nonstructural measures and GIS capabilities into the risk analysis program HEC-FDA. The projected release schedule for the new version is late in fiscal year 2006.

The new features added to the reservoir simulation program HEC-ResSim were substantially completed in FY04. These features included system hydropower and pump-back storage operations, period-average flow requirements, conditional (if-then-else) rule evaluation, scripted state variables and rules, and user-defined reports... In FY05, the new and existing features were extensively tested and refined. Because outstanding issues—including uncontrolled spillway overflow and long-interval (daily) operation—have yet to be resolved, the projected release schedule for the new version has been delayed to the 4th quarter of fiscal year 2006.

Under development for several years, a new program coined HEC-EFM (ecosystem functions model) is emerging as a valuable link between traditional flow-based watershed analysis and ecosystem response. A release is planned in FY 2005.

Another new initiative begun in FY 2004 and carrying through FY 2005 has been coined HEC-WAT, Watershed Analysis Tool. This software will be the integration environment for HEC models, and later program packages developed by others. The HEC models of RAS, HMS, ResSim, FDA, and EFM are to be seamlessly linked in the WAT system. WAT is scheduled for a beta release and on-site workshop at HEC in summer 2006.

### INTEGRATED CIVIL WORKS SYSTEMS

**OMBIL:** NDC's production databases provide water resources facility inventories, outputs, and activities that are integrated into a centralized performance management information system – the Operations and Maintenance Business Information Link (OMBIL). OMBIL encompasses the Civil Works businesses of navigation, hydropower, recreation,



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environmental compliance, environmental stewardship and regulatory. These data are combined and internally distributed through OMBIL decision support system to support a variety of Corps management initiatives, as well as federal and public data requirements.

In support of the Civil Works business performance measurements, NDC extracts expenditure data from CEFMS and combines it with the different business output data to generate efficiency and effectiveness measurements. These measurements are for both internal use in the Corps <https://ombil.usace.army.mil> and submission to higher authority including the Office of Management and Budget (OMB). Also, NDC data supports and is a source for the Corps “Value to the Nation” and the federal government’s recreation access site “rec.gov”.

The navigation data has been integrated with CorpsMap that provides an intranet web-based GIS interface. This web site includes many of the Corps other data layers such as Digital Project Notebook, Inventory of Dams, Bridge Inventory Database, Division and District Boundaries and Real Estate Holdings plus many standard layers such as state, county, congressional district, zip codes and etc.

All of NDC’s publicly available navigation and water transportation data is available via a single gateway at [www.iwr.usace.army.mil/ndc](http://www.iwr.usace.army.mil/ndc) or on its annual CD-ROM. The site also provides links to other Corps, Federal and public sites related to the navigation business. NDC continues to strive to provide single site portals related to various management views for accessing all data and information

**CWMS:** The project to modernize the Water Control Data System (WCDS) software began in FY 1997. Renamed CWMS or Corps Water Management System, and formally identified as an Army AIS, CWMS was fielded in its first operational state in 2002/2003. Since that time, the system has been updated at roughly annual intervals at the thirty plus USACE offices with water control management responsibilities. CWMS supports field-level decision-making within the Corps water management mission. It embodies data acquisition, validation, transformation and management; forecasting, simulation and decision support analysis; and information dissemination. Improvements to the system continue via a field-prioritized betterments program. The current fielded version of CWMS (v 1.4) was released in January 2006. Improvements over the preceding version include the addition of snow-melt modeling, several new features in HEC-ResSim, the capability of storing, retrieving,

and editing rating table information, upgraded data stream processing, new security features, and visualization scaling. The management and funding structure provides for a modest field-directed betterments program that will be ongoing throughout the life cycle of CWMS. Currently, version 2.0 is under development with a planned release near the end of 2006. Version 2.0 will include important revisions to the basic database structures, allowing users within water control more direct access to their data and enabling them to make more effective use of the features inherent in the commercial Oracle database at the center of CWMS. Information about CWMS and other HEC software is available on the HEC Web site: <http://www.hec.usace.army.mil/cwms/>.

### WATER RESOURCES TRAINING AND EDUCATION

#### **PROSPECT Program and Specialty Workshops:**

IWR continued the USACE PROSPECT training program rebound by presenting twenty-six week-long courses (seventeen led by the IWR NCR and nine by HEC). HEC had two field workshops in FY05 (totally two weeks of training). The courses covered a wide range of civil works water resources topics: Public Involvement and Teaming in Planning; Public Involvement – Communications; Regulatory for New Regulators; Regulatory - Procedural Issues; Regulatory - Decision-Making; Regulatory Executive Seminar; Eco-system Restoration Planning/Evaluation; Economic Analysis; and a full menu of hydrologic engineering and planning analysis topics including courses on, HEC-HMS, GIS applications, watershed/river and wetlands restoration courses, and advanced courses in unsteady flow with HMS–RAS and HMS applications. Attendance averaged about 25 students per course.

The specialty workshops focused on HEC software such as HEC-FDA specifically for economists, engineers, and planners from the NRCS and, HEC-HMS; the use of navigation data and information systems; IWR PLAN and cost effectiveness and incremental cost analysis (CEICA).

**Planning Excellence Program:** Throughout FY 05 IWR provided managerial and technical support to the Civil Works Planning Community-of-Practice in the execution of the Planning Excellence Program. This included the management of the Planning Associates Program and the conduct of the two-week “Washington-Experience” orientation for the FY05 class. The goal of the Program is to develop planning leaders who can manage complex planning studies that lead to quality decision documents and who will

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provide water resources technical and professional leadership in the future. IWR, in coordination with HQUSACE, is responsible for the implementation of the Program including the selection of candidates, development and delivery of training sessions, financial management and logistical support. IWR also provided support to the local delivery of selected Planning Core Curriculum Courses by the Corps MSC's. These eight courses provide the basic, full performance training needed by entry level planners across the USACE as the means to accelerate their progress to the journeyman stage of their career development.

Further progress was made on the development of distance learning components of the Advanced Degree Program in Integrated Water Resources Management (formerly titled the Master's Degree Program in Water Resources Planning and Management), which is offered at five Universities, Johns Hopkins, Southern Illinois University, the University of Florida, Harvard University, and the University of Arizona. IWR also provided support to the local delivery of selected Planning Core Curriculum Courses by the Corps MSC's. These eight courses provided the basic, full performance training needed by entry level planners across the USACE as the means to accelerate their progress to the journeyman stage of their career development.

### REIMBURSEABLE TECHNICAL ASSISTANCE

Reimbursable project work was undertaken for Corps field offices as well as HQUSACE Civil Works Planning, Engineering, Operations-Regulatory, and Office of Homeland Security; the HQUSACE Office of Interagency and International Activities; the Corps Engineering Research and Development Center - Coastal and Hydraulics and Environmental Labs; the Federal Emergency Management Agency; the International Joint Commission; the National Oceanic and Atmospheric Administration (National Weather Service), the Department of Interior (USGS), and other Federal agencies, along with approved Thomas Amendment Agreement technical support to the Lower Colorado River Authority, Texas, and the Tampa Bay Water Authority, Florida. Other projects for IWR's USACE clients included navigation systems economic evaluation, technical advice and guidance on plan formulation, incremental cost and cost effectiveness (IC/CE) analysis, risk analysis, watershed and reservoir system modeling, water quality, river hydraulics, wetlands hydrology, water control management, regional statistical analysis, flood damage analysis, flood warning response systems, GIS applications in

hydrology and hydraulics, groundwater modeling and water supply in support of interagency investigations.

Among the most notable reimbursable projects included the completion of the five-year, \$20 million Lake Ontario and St. Lawrence River Study for the International Joint Commission (IJC), which demonstrated the practical application of contemporary IWRM planning concepts and modeling techniques; the completion of Phase 1 modeling of the Tigris-Euphrates Rivers basin, and subsequent extension of the watershed model which included the reconstruction of historical data and completion of the draft Integrated Marsh Restoration Program (IMRP) report; and partnering with (1) USACE ERDC on the provision of capacity building training for staff of the Iraq Ministry of Water Resources, and (2) with the U.S. Geological Survey in providing stream gage installation and training to the Ministry of Water Resources in Iraq.

### CIVIL WORKS PROGRAM AND PROJECT INFORMATION

IWR provides a full range of information on key Civil Works activities including international, national and Corps-wide data and information. National water resources database concept development, design, implementation, operation, and maintenance activities are provided through a combination of in-house and private sector systems analysts, statisticians and engineers/scientists who work in close coordination with Corps users.

**Navigation Data Center:** The Navigation Data Center (NDC) is the central manager of navigation data for the Nation, and NDC provided information directly supports the Corps \$1.8 billion annual navigation program in addition to all other CW programs. NDC is responsible for national level executive oversight and management responsibilities such as the development of both federal and Corps policy and guidance involving Engineering Regulations and the Code of Federal Regulations and their enforcement. The Office of Management and Budget, acting on legislative mandates, recognizes USACE, acting through NDC, as the Federal collection agent for waterborne commerce, vessel activities and waterway infrastructure data and statistics.

NDC accomplishes its objectives of supplying timely and accurate data through the following activities: 1) Assessing user requirements; 2) developing, designing, and operating and maintaining systems to collect, process, and store data and information; 3) developing and disseminating data,

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information and statistics products; 4) training of providers and users; 5) maintaining technological and content interoperability and currency.

As a national statistical center, NDC coordinates extensively with other federal statistical agencies and federal data users, and represents the U.S. Government with foreign governments in the development of data and information standards and protocols; and in the negotiation of data exchanges. Within the Corps NDC actively participates in corporate information integration and coordination and plays a lead role in developing, coordinating and disseminating water resources information for performance measurement and management purposes, and in assisting in the development of strategic communication with both internal communities of practice and external water resources interests, stakeholders and communities. Key information and data provided in FY04 include:

**Waterborne Commerce and Vessel Statistics:** Under the authority of the River & Harbors Act of 1922, as amended, and codified in 33 U.S.C. 555 the Corps is to collect, process, distribute, and archive commercial vessel trip and cargo data. These data and statistics are used to analyze the feasibility of new water transportation projects and activities; to set priorities for new investment and rehabilitation; and for management of the operations and maintenance of existing projects.

Under Federal law, vessel-operating companies must report domestic waterborne commercial vessel movements directly to the Corps. The types of vessels include: dry cargo ships and tankers, barges (loaded and empty), towboats (with or without barges in tow), tugboats, crew boats and supply boats to offshore locations, and newly constructed vessels from the shipyards to the point of delivery. Vessels remaining idle during the monthly reporting period are also reported.

U.S. Foreign waterborne import, export, and in-transit cargo and vessel movement data are provided to the Corps by the U. S. Customs Service, the Bureau of the Census, and the Port Import Export Reporting Service.

Movement data acquired by the Waterborne Commerce Statistic Center of NDC is primarily for the use of the Corps and other governmental agencies. In 2004 these data were incorporated into the Corps budget preparation process and provide the navigation project outputs and performance measures used to rank and justify operation and maintenance funding requests.

Summary statistics, which do not disclose movements of individual companies, are also released to private companies and to the general public.

The Waterborne Commerce Statistics Center's standard publication, *Waterborne Commerce of the United States*, is issued in five parts (Atlantic Coast, Mississippi Valley and Gulf Coast, Great Lakes, Pacific Coast, and a National Summary). Also available is *The Public Domain Database* that contains aggregated origin to destination information of foreign and domestic waterborne cargo movements.

*Transportation Lines of the United States* in three volumes contains a national summary of U.S. vessels, listings of domestic vessel operators, plus details their equipment and references their service areas.

**Navigation Infrastructure Inventory:** This information supports the Corps Federal Central Collection Agency responsibility for documenting the nation's commercial port infrastructure served by Federal channels. In 2005 data for the Virginia ports of Hampton Roads and the James and York Rivers; the ports of southwest and western Alaska; the ports on the Illinois waterway; the port of St Louis, MO and the Upper Mississippi; the ports of Memphis, TN, Helena, AR, Natchez, Vicksburg, Greenville, MS and ports on the Lower Mississippi were updated in the central database. Data for over 9,280 individual docks are available in published reports and on the Internet in summary form and as data files. These data are updated and posted as each port area is re-surveyed and verified as current. A new initiative to survey, for the first time, the ports of Southern Louisiana (west of New Orleans and east of Lake Charles, LA) was begun. The data are used to identify industry served by the federal channels and is part of the budget process prioritization of projects. The Coast Guard is also a prime user of the information in the execution of their homeland security mission.

Another initiative is the establishment of a central database of all Corps navigation projects (Navigation Project Profile) with the critical attributes required for the budget process prioritization process. This information is used in the Operations and Maintenance Business Information System (OMBIL) to more fully describe all aspects of a project

**Lock Performance and Characteristics:** The lock performance database provides the Corps access to individual lock near real-time information as well as summary and performance statistics. A national data warehouse was fully deployed in FY 2005 and provides

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all Corps users direct access to current and historical data and summaries. The data are used by the Corps and other agencies such as the Coast Guard and the TVA in the execution of their missions. Lock characteristics, the physical descriptions of all the Corps owned/operated locks, are available on the web to all users. The lock databases are feeder systems to the Operations and Maintenance Business Information System (OMBIL) decision support system.

**Dredging Statistics:** This web-based ORACLE database is successful in supplying information on all USACE performed and contracted dredging to the Corps, industry and private users. Data entry and report generation is accomplished via the Corps Intranet and enables all Corps members access to the information in the central system. The data are used to generate the Small Business Report for dredging contracts. Biweekly reports are posted on the public web site to inform the industry and public of Corps and contracted dredging activities. Standard reports and summaries plus custom queries and reports are quickly generated to meet Corps and user needs. The use of the information by Corps and industry has resulted in improved bidding competition and a more efficient utilization of dredging equipment. The dredging database is a feeder system to the Operations and Maintenance Business Information Link (OMBIL) decision support system.

All of NDC's publicly available navigation and water transportation data is available via a single gateway at [www.iwr.usace.army.mil/ndc](http://www.iwr.usace.army.mil/ndc) or on its annual CD-ROM. The site also provides links to other Corps, Federal and public sites related to the navigation business. NDC continues to strive to provide single site portals related to various management views for accessing all data and information. Most data are available in both hard copy and electronic form.

**Water Supply:** IWR partnered with Corps MSC's and district offices in FY05 to initiate a study to update the 2004 water supply database (published as IWR Report 05-PS-1). The 2004 database showed there were 134 Corps multipurpose projects that included 9.86 million acre-feet of municipal and industrial (M&I) water supply with a repayment value of \$1.477 million. The Corps has 295 water supply agreements that cover all but about 8% of these costs. The 134 reservoirs are located in 25 states plus Puerto Rico and in 23 of the Corps' 38 districts.

IWR also continued act as the Headquarters' Water Supply Business Program Manager. In this role, the water supply portion of the FY 07 budget was developed through the use of new water supply work

category codes. The Presidents' FY 07 budget included \$2.83 million for the water supply program, up from \$2.0 million in FY '06. As the Water Supply Program Manager, IWR also initiated a water supply data call to develop the joint-use costs associated with multiple purpose water supply projects and participated in the HQUSACE "O&M Joint Cost Project Delivery Team."

### INTERNATIONAL WATER RESOURCES

**Lake Ontario and St. Lawrence River Study:** The International Lake Ontario-St. Lawrence River Study continued to be conducted by the International Joint Commission (IJC) to assess and evaluate the Commission's *Order of Approval* used to regulate outflows from Lake Ontario through the St. Lawrence River. This five-year, \$20 million study is evaluating the impacts of changing water levels on shoreline communities, domestic and industrial water users, commercial navigation, hydropower production, the environment and recreational boating and tourism, along with forecasted effects of climate change. The study is being conducted in full partnership with Canada, and is utilizing a transparent planning process pioneered by IWR and known as "Shared Vision Planning". The open citizen and public participation process is being guided by a volunteer Public Interest Advisory Group (PIAG) appointed by the IJC, while the study team is composed of a broad assembly of multi-disciplinary technical experts on nine technical working groups and led by co-director's from Canada and the U.S. The U.S. co-director is Dr. Eugene Stakhiv of IWR.

During FY05 a series of alternative plans continued to be developed and refined. State-of-the-art models that assessed impacts on erosion, ecological processes, recreational boating, and navigation were developed and presented to basin interests in the U.S. and Canada. Feedback continued to be received on the range of alternative plans which were narrowed during this period to a smaller subset of candidate plans. These were then further coordinated with the public as the Study Board continues towards the approval of its report to the Commissioners in 2006.

**World Water Council:** The CECW Deputy Director for Civil Works represents the USACE on the World Water Council (WWC), with IWR providing technical support and representation on the Council's Institutions and Governance Committee. FY05 activities included the continued planning for the 4<sup>th</sup> World Water Forum (WWF) which will be held in Mexico City in March 2006, and the development and coordination of USG input into the construct of the 4<sup>th</sup>

## INSTITUTE FOR WATER RESOURCES

WWF agenda, consistent with Department of State guidance on international water initiatives and USG policy, such as the Millennium Declaration Goals. IWR deployed a water resources manager to Mexico City in February 2005 to represent the USG in its on-site planning for the 4<sup>th</sup> WWF.

**USACE – UNESCO IHE Partnership:** IWR is the USACE technical agent for administering the Memorandum of Understanding (MOU) between the USACE and UNESCO - Institute of Water Education (IHE). The most significant activity in FY05 was the continued training of 18 month in-residence Master's Degree water specialists from the Iraqi Ministries of Water Resources and Public Works at the IHE-Delft, Netherlands.

**UNESCO – IHP:** The IWR director was part of the United States Government (USG) delegation attending the 16<sup>th</sup> Session of the UNESCO International Hydrologic Programme (IHP) Intergovernmental Council in Paris, France, 20-25 September 2004. This delegation represented the USG as part of the process of re-establishing of the U.S. IHP National Committee, which formally began in 2005 in conjunction with the formation of the U.S National Commission upon the USG reentry into UNESCO.

**USACE - Dutch Rijkswaterstaat Memorandum of Agreement:** The Dutch Rijkswaterstaat (RWS) and the USACE) signed a Memorandum of Agreement (MOA) in May 2004. The scope of that agreement encompasses collaboration in research, development, testing, and evaluation potentially leading to new and/or improved capabilities between the two countries. IWR has the technical lead in the implementation of MOA activities. Upon the signing of the MOA, a strategy was developed to focus the technical exchange along practical lines that were mutually beneficial to the missions of both organizations. Accordingly, six specialty (cluster) areas were formed with co-leaders from both countries identified to lead each specialty area:

- Flood control and flood protection
- Coastal zone management
- River basin management
- Shipping and transport
- Dredging
- Infrastructure management

Several technical exchanges took place in FY05 in both the US and The Netherlands, along with a follow-up visit to the U.S. where the USACE hosted a visit by the RWS Director-General, with joint events in both

Washington, D.C. and New Orleans, Louisiana. Following Hurricane Katrina activities associated with the MOA were primarily re-directed to focus on flood protection measures, coastal zone development and US-Dutch approaches to risk assessment. Several directed exchanges are planned for FY06.

**International Technical/Reimbursable Projects:** FY 2005 continued to yield major growth in technical assistance projects undertaken in cooperation with non-Corps, non-Federal organizations. This includes work in Iraq and Afghanistan for USAID and its contractors, and local government agencies. Projects for these varieties of clients and settings include watershed and reservoir system modeling, water quality, river hydraulics, wetlands hydrology, water control management, regional statistical analysis, GIS applications in hydrology and hydraulics and groundwater modeling.

### INTERNATIONAL NAVIGATION ASSOCIATION (PIANC)

PIANC is an organization consisting of approximately 40 national members. From its headquarters in Brussels, Belgium, it acts as a clearinghouse of technology and experiences relating to ocean and inland navigation improvements which are exchanged among engineers, scientists, port operators, and marina and vessel owners, to name a few. Its objective is to advance, on a worldwide basis, the sustainable development of all kinds of navigation through the exchange of technical information on port and waterway development. The objective of the Association is met by holding International Congresses and by publishing technical bulletins and special reports. Special reports are published describing the results of the work of international research teams, or working groups, composed of those national members interested in the particular subject under study. The organization also serves as an excellent source of identifying individual and corporate expertise throughout the world on PIANC-related subjects. Personal interchange of ideas and information also is promulgated by members attending the International Congresses held once every four years, and technical working group meetings held several times each year.

The business affairs of the Association are managed by the Annual General Assembly (AGA). It is composed of delegates who represent each member government. The number of delegates is determined by the size of the national membership, but may not exceed 11 per country.

## REPORT OF THE SECRETARY OF THE ARMY ON CIVIL WORKS FOR FY 2005

The United States (U.S.), which has been a member of PIANC since 1902, provides an annual appropriation for the support and maintenance of the organization. This includes an annual subvention to PIANC International and payment of a portion of the travel expenses of officially appointed national delegates (Commissioners) of the United States to meetings of the AGA and Congresses. Total annual appropriation for the U.S. Section, PIANC is currently \$45,000, including the annual subvention of approximately \$15,000.

The U.S. Section is administered by law, under the auspices of the Department of the Army (Corps of Engineers). It is located in the Institute for Water Resources (IWR), Casey Building, Humphreys Engineer Center. The U.S. Section is composed of both individual and corporate members who pay membership dues. Membership of the U.S. Section on September 30, 2004, totaled 263, consisting of 216 individual members, 46 corporate members and 1 student member.

**United States National Commission:** The United States National Commission constitutes the governing body of the National Section. In 2004 the ex-officio officers of the U.S. National Commission were: Chairman, John P. Woodley, Jr., Assistant Secretary of the Army (CW)); President, MG Don T. Riley, Director of Civil Works; and Secretary, Mr. Ronald R. Conner an employee of IWR.

In 2004, U. S. National Commissioners were: Mr. Robert D. Nichol, President, Moffatt and Nichol Engineers; Mr. Kurt J. Nagle, President, American Association of Port Authorities; Mr. Charles C. Calhoun, Jr., Vice President representing the Central Region and consultant; Dr. Robert H. Randall, Texas A&M University; Mr. Joseph H. Pyne, President, Kirby Corporation; Ms. Doris J. Bautch, Director, Great Lakes Region, Maritime Administration, U.S. Department of Transportation; Mr. Shiv Batra, Vice President representing the Western Region and President, INCA Engineers, Inc.; and Mr. Thomas H. Wakeman, III, Vice President representing the Eastern Region and General Manager, Waterways Development Division, Port Commerce Department, Port Authority of New York and New Jersey.

Mr. John P. Woodley, Jr., Assistant Secretary of the Army (Civil Works) continued to serve as Chairman, U.S. Section PIANC... Major General Don T. Riley continued to serve as President of the U.S. Section. Mr. Bruce Lambert replaced Mr. Ron Conner as Secretary of the U.S. Section during the summer of 2005.

**PIANC Activities:** In February of 2005, Mr. John P. Woodley, Jr. made a presentation to the American Association of Port Authorities Latin American Executives Meeting in Miami, Florida. This activity was part of the Inter-American Initiative being led by the U.S. Section PIANC. The U.S. Section, jointly with the AAPA, developed a survey on dredging and technical port needs that was distributed to AAPA's Latin American and Caribbean members.

In May of 2005, the U.S. Section hosted the PIANC International Annual General Assembly in Charleston, S.C. The U.S. Delegation composed of Mr. Woodley, MG Don T. Riley, Mr. Ronald Conner, Mr. Shiv Batra, Ms. Doris Bautch, Mr. Charles Calhoun, Mr. Kurt Nagle, Mr. Harry Cook, Mr. Robert Nichol, Mr. Tom Wakeman, and Mr. Thorndike Saville attended the Annual General Assembly in Fukuoka, Japan. Dr. Robert Engler and Dr. Sandra Knight also attended. The major resolution was entitled "PIANC for the Americas", which supports the U.S. Section Latin American Initiatives. The U.S. Section also hosted a technical meeting, with a morning session on Latin American port issues, and an afternoon section on various research topics in the U.S. The U.S. Section also signed a Memorandum of Understanding of the AAPA, to work jointly on technical assistance with Latin American regions.

The U.S. Section PIANC (International Navigation Association) held its Annual Meeting October 20, 2004 in Baltimore, Maryland. A morning business meeting was followed by an afternoon seminar on Container-on-Barge Transport: Implications for Navigation Infrastructure. The U.S. Section Commissioners also held a meeting during this event.

Other major efforts that began in 2005 are the development of a new strategic plan for the U.S. Section of PIANC, a Memorandum of Understanding with the Organization of American States, Inter-American Committee on Ports, and .

The second U.S. Section PIANC Scholarship was awarded to Mr. Nicholas Zager, a top junior Ocean Engineering student at Texas A & M University.

The U.S. winner of the 2005 DePaepe-Willems Award was Mrs. Shana Heisey of the Institute for Water Resources, U.S. Army Corps of Engineers.

**Representatives to Committees and Commissions:** The principal business of PIANC is the

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sponsorship of technical working groups. The U.S. Section is represented by Principal and Co-Principal Members of the Commissions managing the activities of the technical working groups. The representatives were:

**Environmental Commission** – Mr. Edmond Russo, U.S. Army Corps of Engineers, New Orleans District (U.S. Principal Representative), and Dr. Robert Engler, Engineer Research and Development Center (Chairman of the Environmental Commission).

**Inland Navigation Commission** – Mr. Shiv Batra, President of INCA Engineers, Inc. (U.S. Principal Representative) and Dr. Sandra K. Knight, P.E., USACE, Engineer Research and Development Center (Chairman of the Inland Navigation Commission).

**Maritime Navigation Commission** – Mr. E. Dan Allen, Moffatt & Nichol.

**Recreational Navigation Commission** -- Mr. Richard B. Dornhelm, Moffatt & Nichol; Co-Principal, Jack C. Cox, TetraTechFW.

### New Technical Working Groups:

In 2005, nine new Working Groups were formed. The groups are listed below along with the name of the Principal U.S. Representative.

**InCom 29** Innovations in Navigation Lock Design  
David Schaaf, USACE, LRL and Dale Miller, INCA Engineers

**InCom 30** Inventory of Inspection and Repair Techniques of Navigation Structures (Steel, Concrete, Masonry and Timber) both Underwater and In-the-Dry  
Ron Heffron, Moffatt & Nichol

**InCom 31** Organization and Management of river ports,  
Mr. Jim McCarville, Port of Pittsburgh

**MarCom 49** Horizontal and Vertical Dimensions of Fairways  
Michael J. Briggs, USACE, ERDC

**MarCom 50** General principles for the design of maritime structures  
Bill Paparis, HPA

**MarCom 51** Water injection dredging  
Timothy L. Welp, USACE, Research & Development Ctr.

**MarCom 52** Criteria for the (Un-)Loading of Container Ships  
Dan Allen, Moffatt & Nichol Engineers

**MarCom 53** Design and construction of maritime structures in tsunami prone areas  
John R. Headland, Moffatt & Nichol Engineers, Michael J. Briggs, USACE, ERDC

**EnviCom 15** Environmental Aspects of Dredging and Port Construction Around Coral Reefs and Cold Water Hard Bottom Benthic Communities  
Penny L. Cutt, USACE, Jacksonville District

### Working Group Reports Published in 2005:

**InCom 21** Economic aspects of waterways

**MarCom 44**, Accelerated Low Water Corrosion (+ cd-rom)

**MarCom 36** Catalogue of Prefabricated Elements (+ cd-rom)

**MarCom 34** Recommandations relatives aux normes parasismiques pour les structures portuaires

**RecCom 10** Systèmes d'amarrage pour la navigation de plaisance

**EnviCom 08** Biological Assessment Guidance for Dredged Material

**EnviCom 02** Bird Management in Ports and Waterways

### Active Working Groups and the names of the U. S. Representatives:

**InCom WG 23, Technical and Economic Problems of Channel Icing.**  
Mr. Claude Strauser, USACE District, St. Louis.

**InCom WG 25, Maintenance and Renovation of Navigation Infrastructure.**  
Dr. James McDonald, USACE-ERDC (retired) was the U.S. representative and chaired the committee. Mr. James Blanchar, USACE-MVR (retired) served as corresponding member.

**InCom WG 26, Design of Control Structures Used on Navigable Waterways: Controllable Weirs and Gates.**

## REPORT OF THE SECRETARY OF THE ARMY ON CIVIL WORKS FOR FY 2005

Mr. Dale Miller, INCA Engineers and Dr. Richard Stockstill, USACE-ERDC

**InCom WG 27, Guidelines for Environmental Impacts of Vessels.**

Dr. Thomas Keevin, USACE-St. Louis District

**MarCom WG 36, Catalogue of Precast Elements.**

Dr. Billy L. Edge, Texas- A&M University

**MarCom WG 39, Monitoring of Breakwaters.**

Mr. James D. Prehn, RLS, Special Data Survey

**MarCom WG 42, Life Cycle Management of Port Structures – Implementation Manual.**

Dr. Valery M. Buslov, Hans-Padron Associates

**MarCom WG 43, Minimizing Harbor Siltation.**

Dr. John Headland, Moffatt & Nichol

**MarCom WG 44, Accelerated Low Water Corrosion.**

Dr. Ashok Kumar, USACE-ERDC

**MarCom WG 45, Post Earthquake Actions for the Restoration of Port Structures.**

Dr. Stephen Dickenson, Oregon State University

**MarCom WG 46, Maritime Freight Transshipment.**

Ms. Doris Bautch, Maritime Administration, U.S. Department of Transportation

**MarCom 47, Criteria for the Selection of Breakwater Types and their Optimum Damage Risk Level.**

Dr. Jeffrey A. Melby, USACE ERDC

**MarCom WG 48, Guidelines for Port Constructions, related to Bowthrusters.**

Mr. Marcel Hermans of the Port of Portland and Mr. Gary Greene, Gary Greene Engineers.

**RecCom WG 14, Access to Sport and Recreation Boating for Persons with Disabilities.**

Mr. Daniel Natchez, Daniel S. Natchez and Associates, Inc

**RecCom WG 15, The Use of Alternative Materials in Marina Construction.**

Mr. Terrence Browne, Collins Engineering

**RecCom WG 16, Protecting Water Quality in Marinas,**

Mr. Jack Cox , TetraTechFW and Mr. David Dykstra, Moffatt & Nichol

**RecCom WG 17, Guidelines for Marina Design,**

Mr. Dennis Kissman, Marina Mgt. Services, Inc.

**EnviCom WG 9, Environmental Impacts of Polar Marine Activities.**

Jon E. Zufelt, Ph.D., USACE, ERDC, Cold Regions Research Engineering Laboratory.

**EnviCom 10, Environmental Risk Assessment in Dredging and Dredged Material Management.**

Dr. Jerome Cura, Menzie-Cura & Associates

**EnviCom 11, Management, Dredged Material Re-use and Transformation of Existing Confined Disposal Facilities.**

Dr. Michael Palermo, USACE-ERDC

**EnviCom WG 12, Sustainable Waterways within the Context of Navigation and Flood Management,**

Dr. Craig Fischenich, U.S. Army Engineering Research and Development Center and Mr. John D. Clarkson, USACE, Huntington District

**EnviCom Experts Group 2 , Environmental Benefits of Waterborne Transport.**

Dr. David A. Moser, USACE, Institute for Water Resources

**EnviCom WG 13, Best Management Practices Applied to Dredging and Dredged Material Disposal Projects for Protection of the Environment.**

Mr. Thomas Wang, Anchor Environmental LLC and Dr. Douglas Clarke, USACE ERDC

**EnviCom WG 14, Dredged Material Beneficial Use Options and Constraints.**

Mr. Richard F. Gorini, J. Simmons Group



## INTERNATIONAL BOUNDARY WATERS BOARDS

In order to carry out United States obligations under international agreements, the Office of the Chief of Engineers and several Corps divisions and districts with jurisdiction over areas bordering Canada have representation on numerous international boards, committees, and other groups. The majority of these boards were established by the International Joint Commission (IJC) as empowered in accordance with the provisions of the Boundary Waters Treaty of 1909 between the United States and Great Britain (for Canada). IJC boards fall into two broad categories: boards of control, which are more or less permanent and supervise compliance over an IJC order; and engineering, technical, or study boards, which are usually dissolved after completing and reporting on an investigation assignment.

In addition to boards created by the Commission, other international boards and committees are created by treaties or other arrangement in matters concerned with the water resources of joint interest, and the members report directly to the Governments or establishing agency. International boundary waters boards and committees having Corps of Engineers memberships during the fiscal year are listed in Table 45-1. For an explanation of the

constitution of the various boards and committees, see the annual reports, Volume II for fiscal years 1977 and 1980.

In recent years the IJC has adopted an ecosystem approach for its Boards with a view toward amalgamating a number of its Boards, where it makes sense to do so, as a first step in the development of international watershed Boards. This approach stemmed from the Commission's recommendations in its 1997 report to the governments of the United States and Canada. This report was provided at the request of governments for a proposal on how the IJC might best assist them to meet the environmental challenges of the 21<sup>st</sup> century. Subsequently, governments asked the Commission, in a reference dated November 19, 1998, to further define the framework for operation of international watershed boards as recommended by the IJC in its 1997 report. The IJC provided governments with status reports in December 2000 and June 2005 on the matter and several of its boards have been amalgamated since 1998.

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**TABLE 45-1**  
**International Boundary Waters Boards Having Corps of Engineers Members**

<u>BOARD NAME</u>	<u>YEAR ESTABLISHED</u>	<u>UNITED STATES REPRESENTATION</u>
1. Int. Lake Superior	1914	* Division Engineer, Great Lakes and Ohio River Division -- <u>Chicago District Engineer -designated Alternate</u>
2. Int. St. Croix River**	1915	*District Engineer, New England District
3. Int. Lake Memphremagog	1920	*District Engineer, New York
4. Int. Lake of the Woods Control Board	1925	*District Engineer St. Paul
5. Int. Lake Champlain	1937	*District Engineer, New York
6. Int. Kootenay Lake	1938	*1. District Engineer, Seattle 2. Dept. of Interior, USGS, Boise, ID
7. Int. Rainy Lake Board of Control	1941	*1. District Engineer, St. Paul 2. <u>Resource Biologist, Retired</u>
8. Int. Osoyoos Lake	1943	1. District Engineer, Seattle 2. *Dept. of Interior, USGS, Tacoma, WA 3. Washington State Parks & Recreation Commission, Olympia, WA

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# REPORT OF THE SECRETARY OF THE ARMY ON CIVIL WORKS ACTIVITIES FOR FY 2005

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BOARD NAME	YEAR ESTABLISHED	UNITED STATES REPRESENTATION	
9. Int. Red River Board ***	2000	<ol style="list-style-type: none"> <li>District Engineer, St. Paul</li> <li>* Dept. of Interior, USBR, Billings, MT</li> <li>Dept. of Interior, EPA, Denver, CO</li> <li>Dept. of Interior, USGS, Bismarck, ND</li> <li><u>Sand Hill River Watershed District, Fertile, MN</u></li> <li>ND State Water Commission, <u>West Fargo, ND</u></li> <li>MN Pollution Control Agency, Detroit Lakes, MN</li> <li>MN Dept. of Natural Resources, Bemidji, MN</li> <li>ND Dept. of Health, Bismarck, ND</li> </ol>	<p>Deleted: Mayor, City of Fargo, ND</p> <p>Formatted: Font color: Auto</p> <p>Deleted: Bismarck</p>
10. Int. Niagara	1953	<ol style="list-style-type: none"> <li>*Division Engineer, Great Lakes and Ohio River Division -- <u>Chicago District Engineer-designated Alternate</u></li> <li>Dept. of Energy, FERC, Wash., D.C.</li> </ol>	
11. Int. St Lawrence River	1953	<ol style="list-style-type: none"> <li>*Division Engineer, Great Lakes and Ohio River Division <u>Chicago District Engineer-designated Alternate</u></li> <li>Civil Engineer, Retired</li> <li>NYSDEC</li> <li>Rochester Institute of Technology</li> <li><u>Atlantic Philanthropies</u></li> </ol>	<p>Deleted: New York Power Authority</p> <p>Deleted: Cornell University</p> <p>Deleted: *</p> <p>Deleted: Division Engineer –</p>
12. Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data	1953	<ol style="list-style-type: none"> <li>Great Lakes and Ohio River Division</li> <li>Dept. of Commerce, Ann Arbor, MI</li> </ol>	
13. Int. Niagara Committee	1955	*Division Engineer, Great Lakes and Ohio River Division	
14. Int. Souris River Board ****	2001	<ol style="list-style-type: none"> <li>District Engineer, St. Paul</li> <li>*ND State Engr., Bismark, ND</li> <li>Dept. of Interior, USGS, Bismarck, ND</li> </ol>	
15. Columbia River Treaty Entities	1964	<ol style="list-style-type: none"> <li>Division Engineer, Northwestern Division</li> <li>*Administrator of Bonneville Power Admin., Portland, OR</li> </ol>	<p>Formatted: Font color: Auto</p>
16. Columbia River Treaty, Permanent Energy Board	1964	<ol style="list-style-type: none"> <li>*HQUSACE, Deputy Director of Civil Works, Wash., D.C.</li> <li>Department of Energy, Newberg, OR</li> </ol>	<p>Formatted: Font color: Auto</p> <p>Formatted: Font color: Auto</p>
<u>17. Int. Champlain-Richelieu</u>	<u>1975</u>	<ol style="list-style-type: none"> <li>*<u>New York Dept. Environmental Conservation</u></li> <li><u>District Engineer, New York</u></li> <li><u>Vermont Environmental Conservation Agency</u></li> <li><u>New England River Basins Commission, Staff Associate</u></li> <li><u>Dept. of Interior F&amp;WS, Boston, MA</u></li> </ol>	<p>Formatted: Font color: Auto</p> <p>Formatted: Bullets and Numbering</p> <p>Formatted: Bullets and Numbering</p>
<u>18. Lake Ontario - St. Lawrence River Study Board</u>	<u>2001</u>	<ol style="list-style-type: none"> <li>* <u>Institute for Water Resources (IWR)</u></li> <li><u>NY Department of Environmental Conservation</u></li> <li><u>Cornell University</u></li> <li><u>Rochester Institute of Technology</u></li> <li><u>Saint Regis Mohawk Tribe</u></li> <li><u>Private Citizens (2)</u></li> </ol>	
<p>* Signifies U.S. Section Chairman</p> <p>** In September 2000, the International Joint Commission formally combined its existing International St. Croix River Board of Control and its International Advisory Board on Pollution Control - St. Croix River and established the International St. Croix River Board.</p> <p>*** Amalgamated Board Comprised of Former Int. Red River Pollution Board and Red River Portion of Former Int. Souris-Red Rivers Engineering Board</p>			<p>Deleted: ¶</p> <p>Formatted: Border: Bottom: (No border)</p> <p>Deleted: ¶</p> <p>Deleted:</p> <p>Deleted: d</p> <p>Deleted: ¶</p>

\*\*\*\* Amalgamated Board Comprised of Former Int. Souris River Board of Control and Souris River Portion of Former Int. Souris-Red Rivers Engineering Board.

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### Comprehensive Study on Regulating Water Levels on Lake Ontario and in the St. Lawrence River.

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In FY2001, the International Joint Commission formed the Lake Ontario - St. Lawrence River Study Board to undertake a comprehensive five-year study to assess and evaluate the current criteria used for regulating water levels on Lake Ontario and in the St. Lawrence River. The Study Board engaged by the IJC is a bi-national group of diverse experts from government, academia, native communities, and interest groups representing the geographical, scientific and community concerns of the Lake Ontario - St. Lawrence River system. The U.S. Director of the Study is from IWR. The Corps of Engineers leads 5 of the 9 Technical Work Groups, and participates on 2 others.

The Mission of the Study is to consider, develop, evaluate and recommend updates and changes to the 1956 criteria for Lake Ontario-St. Lawrence River water levels and flow regulation, taking into account how water level fluctuations affect all interests and changing conditions in the system including climate change, all within the terms of the Boundary Waters Treaty. The Study Board is completing its studies to provide the IJC with the information it needs to evaluate options for regulating levels and flows in the Lake Ontario-St. Lawrence River system in order to benefit affected interests and the system as a whole. These studies include:

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a. Reviewing the operation of the structures controlling the levels and flows of the Lake Ontario-St. Lawrence River system in the light of the impacts of those operations on affected interests, including the environment.

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b. Assessing whether changes to the Order of Approval or regulation plan are warranted to meet contemporary and emerging needs, interests and preferences for managing the system in a sustainable manner; and

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c. Evaluating any options identified to improve the operating rules and criteria governing the system.

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The Study Board will provide, by the end of 2005, three candidate regulation plans for the IJC's consideration. The Study Board will hold a series of public meetings in the summer of 2005 to obtain public input on the candidate plans prior to submitting them to the IJC.

### **Upper Great Lakes Plan of Study**

The IJC has decided to revise its plan for an Upper Great Lakes Study. The original Upper Great Lakes Plan of Study was submitted to the U.S. and Canadian governments in 2002. Its purpose was to provide a plan to review IJC Orders for Lake Superior outflow regulation and consequently water level impacts on affected interests in the upper Great Lakes system from Lake Superior downstream through Lake Erie.

While this original intent of the Study has not changed, two more recent events that might impact the study will be added to the study plan. The first issue is that of possible ongoing physical changes in the upper St. Clair River, which could impact water level changes on the upstream lake (Michigan-Huron) and downstream lakes (St. Clair and Erie). The second issue is that the Lake Ontario - St. Lawrence River Study is nearing completion. This may provide many lessons learned to help streamline the Upper Lakes Study.

The IJC recently appointed an Upper Lakes Plan of Study Revision Team. The U.S. Team Leader is the Detroit District Commander. A draft revised Plan of Study will be completed in August 2005. Public meetings will be held in September 2005. Following public consultation the final Plan of Study will be submitted to the IJC in October 2005. Any actual implementation of the Plan of Study would not be initiated until funds are appropriated by the Governments of the United States and Canada.

**REGULATORY, SUNKEN VESSEL REMOVAL AND  
NATIONAL EMERGENCY PREPAREDNESS ACTIVITIES**

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## 1. Regulatory Activities

**Authorities.** The following authorities charge the Corps of Engineers with the regulation of various construction related activities in U. S. waters and wetlands: Sections 9 and 10 of the Rivers and Harbors Act of 1899 (structures in waterways and the alteration of waterways); Section 103 of the Marine, Protection, Research, and Sanctuaries Act of 1972 (Ocean Dumping); and Section 404 of the Clean Water Act (discharge of dredged or fill material).

**Work Completed.** During FY 2005, the Corps reviewed and authorized more than 95,000 permit activities, 88 percent of which were approved within 60 days. Approximately 8,000 projects were issued individual permits, and the remaining 87,000 activities were reviewed and approved under regional or nationwide general permits. General permits are issued to the public at large and define types of minor activities with no more than minimal adverse effects on the aquatic environment, which do not usually require the extensive review necessary for projects authorized by individual permits. Use of general permits provides significant relief to the regulated public by avoiding red tape for small projects with minimal environmental impacts. The Corps denied approximately 300 permits during FY 2005, since most projects which might otherwise have been denied a permit were either modified or conditioned to meet Corps requirements, scaled down to qualify for approval under general permits, or withdrawn. About 4,300 permit applications were either withdrawn or canceled. Under the regulatory program, the Corps made over 100,000 jurisdiction determinations in FY 2005, many of which were made in response to requests from landowners who were not applying for permits

The Corps investigated approximately 5,500 alleged illegal activities, most of which were violations of Section 404 of the Clean Water Act. Under the permit program in FY 2005,

the Corps authorized the filling of approximately 20,500 acres of wetlands but required the restoration, enhancement, or creation of more than 50,000 wetland acres.

As required by section 314 of the National Defense Authorization Act for Fiscal Year 2004 (P.L. 108-136), the Corps, in cooperation with EPA, has drafted regulations establishing performance standards and criteria for compensatory mitigation required for Department of the Army permits. The regulations will apply equivalent standards, to the extent practicable, for compensatory mitigation done by permittees and mitigation banks. The proposed rule was issued in March 2006 and should be finalized by December of 2006.

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REPORT OF THE SECRETARY OF THE ARMY ON CIVIL WORKS ACTIVITIES FOR FY 2005

TABLE A  
GENERAL REGULATORY FUNCTIONS

Obligations

Unobligated Balance - 30 Sep 04  
Allotments

\$ 3,269,509  
\$ 139,138,087

Total Funds Available  
Obligations

\$ 142,407,596  
\$ 140,596,752

Unobligated Balance- 30 Sep 05

\$ 2,560,504

Expenditures

Unexpended Balance - 30 Sep 04  
Allotment

\$ 4,500,806  
\$ 139,138,087

Total Funds Available

\$ 143,638,893

Expenditures

Unexpended Balance - 30 Sep 05

\$ 142,672,028  
\$ 6,419,693

Investigation and Removal of Sunken Vessels

Under the authority of Sections 19 and 20 of the River and Harbor Act of 1899, the Corps of Engineers investigated sunken vessels in navigable waters and removed those obstructing navigation. For obligation expenditures, see Table B (next page)

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**REGULATORY, SUNKEN VESSEL REMOVAL AND NATIONAL EMERGENCY PREPAREDNESS ACTIVITIES**

**TABLE B**  
**REMOVAL OF SUNKEN VESSELS**  
((\$000))

<u>Obligations</u>	
Unobligated Balance - 30 Sep 03	\$ 0.6
Allotment	\$ 475.9*
Total Funds Available	\$ 468.6
Obligations	\$ 65.8**
Unobligated Balance - 30 Sep 04	\$ 0.9
<u>Expenditures</u>	
Unexpended Balance - 30 Sep 03	\$ 0.6
Allotment	\$ 468.0*
Total Funds Available	\$ 468.6
Expenditures	\$ 65.8**
Unexpended Balance - 30 Sep 04	\$ 0.9

\* \$500 less O&M Savings and Slippage

\*\* \$401.9 Reprogrammed Out Of This Program During FY 2004

**2. National Emergency Preparedness Activities**

**Authority.** Executive Orders 10480 and 12656 and the Federal Emergency Management Agency (FEMA) under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 USC 5121 et seq. are the basis of the Federal Response Plan. The cited executive directives assign significant responsibilities for such preparation (planning, training, research and testing) to the Corps. This includes responsibility for development of comprehensive national level preparedness plans and guidance for response to all regional/national emergencies, whether caused by natural phenomena or acts of man, plans for response(s) to acts of terrorism, and the local preparedness necessary to support Corps continuity of operations. The Corps provides engineering and construction support to state and local governments in response to catastrophic natural/technological disasters. Rapid response to disasters of a regional/national magnitude requires that extensive pre-emergency planning and preparedness activities be conducted to assure the availability of a work force capable of shifting from routine missions to crisis operations and the organizational command and control structure(s) necessary to provide a coordinated and comprehensive response in the critical early stages of a catastrophic disaster.

**Status.** During FY 2005, the Corps of Engineers continued its effort to improve the command's readiness posture and its ability to respond to various national/regional catastrophic disasters to include terrorists' attacks. Emphasis has been on those activities to prepare for catastrophic natural and technological disasters requiring major Federal support of state and local governments overwhelmed by a disaster event, and for national level emergency water planning. The primary focus during FY 2005 continued to provide support to two major national level civil planning areas: (a) support to the nation's ability to mobilize national assets to meet national/regional level emergencies and (b) support to continuity of government and continuity of operations during national emergencies. Lessons learned from past hurricanes, floods, earthquakes, and events of September 11, 2001 as well as more recent events such as the fifteen hurricanes during the 2005 hurricane season, especially hurricanes Katrina and Rita, indicate that improvements in response to catastrophic disasters are still required. In this regard, the Corps continues to emphasize a program that uses the deliberate planning process to develop scenario specific catastrophic disaster plans. This will result in more detailed planning and should provide for a more comprehensive response to national/regional catastrophic disasters to include terrorist attacks. More extensive coordination with

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Federal, state and local entities will be incorporated into plan development. In this regard, following FEMA's program focus, USACE continues to play a key role in national security planning such as supporting Homeland Security strategic planning efforts, development of the National Capitol Region Response Plan and other plans as the New Madrid Earthquake, the South Florida Hurricane, the Southern California Earthquake, the New Orleans Hurricane and other contingencies with national implications. Additional efforts focus on continuing to strengthen COOP readiness. Exercises, involving federal, state and local officials, contribute to a more timely and effective execution of Corps responsibilities during disasters that have national impacts. Major efforts have been made since September 11 for continued inter-jurisdictional collaboration in planning, training, and exercising to improve preparedness for a terrorist event in the NCR. A regional response to a WMD incident requires intense intergovernmental and inter-jurisdictional collaboration and cooperation, as was evidenced by the response at the Pentagon 9/11 incident. Continuing to capitalize on existing planning efforts and forums, and taking advantage of the current atmosphere of urgency regarding emergency preparedness will advance preparedness among all levels of government to improve response and ensure the health and safety of citizens, workers, and visitors in the metropolitan Washington region. The U.S. Army Corps of Engineers (USACE) and the Federal Emergency Management Agency (FEMA) co-sponsored the 2005 Senior Leaders' Seminar

(SLS) on 15-16 June 2005 in Washington, DC. The 2005 SLS represented an important step in the evolution of the seminar series. It was predicated upon the use of the National Response Plan (NRP) and the National Incident Management System (NIMS) as well as the FEMA Hurricane Concept of Operations (CONOP) and USACE support to the NRP. The SLS provided a walk through of hurricane operations, testing both ESF #3 Remedial Action Program results and proposed integrated operations concepts, resulting in the development of a unified operational plan for the 2005 Hurricane Season, as agreed upon by the states, regions and Divisions. The SLS brought together federal, state, and local government organizations for candid, solution-focused discussion about intergovernmental prevention, preparedness, response and recovery for simultaneous natural disasters. The scenario was intended to provide a means for review of the changes in federal, state, and local doctrine, policy, and procedures resulting from the Remedial Action Plan and impacts to the 2005 CONOP. While the scope of this workshop focused on response, it also covered the proposed sequence for requisition and tracking of commodities, materials, and personnel resources surrounding any event from the federal, state, and local perspectives. Participants were asked to address topics such as contingency plans, agency authorities, and interagency coordination to successfully meet both the short and long term needs resulting from a hurricane. For National Emergency Preparedness fiscal year obligations and expenditures, see Table C.

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**Deleted:** used a tabletop exercise format to bring together Federal, State, local and private sector partners for candid, solution-focused discussion about infrastructure related issues from a terrorist incident, looking at both infrastructure protection and recovery. The SLS provided an excellent opportunity for the incident management community at all levels of government and in the private sector to gather to ensure our operations are efficient, effective, and complementary. The seminar also allowed USACE, FEMA and their partner agencies to further build a corrective action program to track the resolution of issues raised at the seminars and in disaster after action critiques. The SLS convened senior policy and operational personnel from selected federal, state and local government agencies and private sector organizations who reviewed and discussed the immediate impacts of recent Department of Homeland Security initiatives on the national response system; discussed current plans and strategies for resolving recovery issues identified in past senior leadership seminars, including disaster housing, contaminated debris management, and infrastructure restoration; and examined the new operational relationships and protocols established by the NRP, particularly in emergency support function areas of Infrastructure, Mass Care, Housing and Human Services and Economic Stabilization, Community Recovery and Mitigation and the Catastrophic Incident Response Annex, to successfully coordinate recovery. ¶

**Deleted:** A HQUSACE Table-Top Exercise (TTEX) was held on 4 May 2004 in Washington, DC. The format of the TTEX was revised from previous events in that it was not executed as a scenario driven tabletop exercise, but rather as a "HQUSACE Round Table" discussion with a general theme of "Readiness in the USACE 2012 Environment." The primary goal of the HQTTEX was to provide a facilitated forum in which senior HQUSACE staff principals and MSC representatives could work together to ensure continued readiness to respond to any contingency by reviewing preparedness/response roles and expectations; identifying, through focused discussions, critical issues or shortfalls associated with the ongoing implementation of the USACE 2012 organization and new management tools while supporting the Global War on Terrorism and the Initial National Response Plan (INRP). Main topics included USACE 2012, Readiness... [10]

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**TABLE C**  
**NATIONAL EMERGENCY PREPAREDNESS**

Obligations

Unobligated Balance - 30 Sep 04	\$ 1,134,766
Appropriations FY 05	\$ 5,000,000
Total Funds Available	\$ 6,314,766
Obligations FY 05	\$ 3,335,979
Unobligated Balance - 30 Sep 05	\$ 2,058,493

Expenditures

Unexpended Balance - 30 Sep 04	\$ 3,478,984
Appropriations FY 05	\$ 5,000,000
Total Funds Available	\$ 8,478,984
Expenditures FY 05	\$ 4,044,094
Unexpended Balance - 30 Sep 05	\$ 3,694,596

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On January 9, 2001 the U.S. Supreme Court invalidated a Corps permit denial by the Chicago District for the filling of isolated waters associated with a landfill by the Solid Waste Agency of Northern Cook County (SWANCC). The Court determined that the Corps long established protocol of asserting section 404 jurisdiction based on use of waters by migratory birds was not supported by the Clean Water Act. This called into question other Section 404 jurisdictional criteria. The Corps and EPA published an Advanced Notice of Proposed Rule Making (ANPRM) on SWANCC jurisdictional issues in January, FY 2003. Subsequent review of the public comments to the ANPRM resulted in the decision not to conduct a rule-making and concentrate on improving consistency issues with regard to jurisdictional determinations nationwide.

rule will also establish standards for the review, approval, and operation of mitigation banks. The statutory deadline for promulgating the final rule is November 24, 2005.

## REGULATORY, SUNKEN VESSEL REMOVAL AND NATIONAL EMERGENCY PREPAREDNESS ACTIVITIES

**TABLE B**  
**REMOVAL OF SUNKEN VESSELS**  
(\$000)

Obligations	
Unobligated Balance - 30 Sep 02	\$ 16.1
Allotment	\$ 475.9*
Total Funds Available	\$ 492.0
Obligations	\$ 577.6**
Unobligated Balance - 30 Sep 03	\$ 10.0
Expenditures	
Unexpended Balance - 30 Sep 02	\$ 16.1
Allotment	\$ 475.9*
Total Funds Available	\$ 492.0
Expenditures	\$ 577.0**
Unexpended Balance - 30 Sep 03	\$ 0.6

\* \$500 less O&M Savings and Slippage

\*\* \$85.6 Reprogrammed Into This Program During FY

2004

## ~~2. National Emergency Preparedness~~ Section Break (Continued) ~~preparedness plans and guidance for response to all regional/national emergencies, whether caused by natural phenomena or acts of man, plans for response(s) to acts of terrorism, and the local preparedness necessary to support Corps continuity of operations. The Corps provides engineering and construction support to state and local governments in response to catastrophic natural/technological disasters. Rapid response to disasters of a regional/national magnitude requires that extensive pre-emergency planning and preparedness activities be conducted to assure the availability of a work~~

**Authority.** Executive Orders 10480 and 12656 and the Federal Emergency Management Agency (FEMA) under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 USC 5121 et seq. are the basis of the Federal Response Plan. The cited executive directives assign significant responsibilities for such preparation (planning, training, research and testing) to the Corps. This includes responsibility for development of comprehensive national level

force capable of shifting from routine missions to crisis operations and the organizational command and control structure(s) necessary to provide a coordinated and comprehensive response in the critical early stages of a catastrophic disaster.

**Status.** During FY

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2004, the Corps of Engineers continued its effort to improve the command's readiness posture and its ability to respond to various national/regional catastrophic disasters to include terrorists attacks. Emphasis has been on those activities to prepare for catastrophic natural and technological disasters requiring major Federal support of state and local governments overwhelmed by a disaster event, and for national level emergency water planning. The primary focus during FY

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2004 was to provide support to two major national level civil planning areas: (a) support to the nation's ability to mobilize national assets to meet national/regional level emergencies and (b) support to continuity of government and continuity of operations during national emergencies. Lessons learned from past hurricanes, floods, earthquakes, and events of September 11, 2001 as well as more recent events such as Hurricane Isabel, the National Capitol Region workshop, the Alaskan Hurricane CPX and the evolving New Madrid earthquake scenario, clearly indicate that the current system does not adequately provide for a response to catastrophic disasters that is sufficiently timely or comprehensive. In this regard, the Corps has initiated a program that uses the deliberate planning process to develop scenario specific catastrophic disaster plans. This will result in more detailed planning and should provide for a more comprehensive response to national/regional catastrophic disasters to include terrorist attacks. More extensive coordination with Federal, state and local entities will be incorporated into plan development. In this regard, following FEMA's program focus, USACE continues to play a key role in national security planning such as supporting Homeland Security strategic planning efforts, development of the National Capitol Region Response Plan and other plans as the New Madrid Earthquake, the South Florida Hurricane, the Southern California Earthquake, the New Orleans Hurricane and other contingencies with national implications. Additional efforts focus on continuing to strengthen COOP readiness. Exercises, involving federal, state and local officials, contribute to a more timely and effective execution of Corps responsibilities during disasters that have national impacts. In November

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2004, a U.S. Army Corps of Engineers Regional Response Workshop was held in Anchorage Alaska. This workshop served to validate the Anchorage Earthquake Catastrophic Disaster Response Plan (CDRP), serve as a means of addressing the unique requirements of a CDRP occurring in an extremely harsh environment, and to set the stage and planning for a related Command Post Exercise (CPX). A North Atlantic Division Weapons of Mass Destruction Regional Readiness Workshop was conducted in the Washington DC area in April

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2004. This workshop served to provide an understanding of U.S. Army Corps of Engineers (USACE) roles and responsibilities under the Federal Response Plan, particularly by examining the evolving USACE and ESF #3 role in relation to the department of Homeland Security and the National Capitol Region Weapons of Mass Destruction Incident Contingency Plan. Major efforts have been made since September 11 for continued inter-jurisdictional collaboration in planning, training, and exercising to improve preparedness for a terrorist event in the NCR. A regional response to a WMD incident requires intense intergovernmental and inter-jurisdictional collaboration and cooperation, as was evidenced by the response at the Pentagon 9/11 incident. Continuing to capitalize on existing planning efforts and forums, and taking advantage of the current atmosphere of urgency regarding emergency preparedness will advance preparedness among all levels of government to improve response and ensure the health and safety of citizens, workers, and visitors in the metropolitan Washington region. A HQUSACE Table-Top Exercise (TTEX) was held on 6 May

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2004 in Washington, DC. The TTEX explored the ramifications of a multi-strike terrorism event while a hurricane was impacting the east coast, particularly the National Capital Region. Portions of Virginia, Maryland, and New Jersey were impacted by high winds and flooding before the storm moved back out into the Atlantic. During the TTEX, besides the hurricane response, USACE staff also had to work around depleted resources from the ongoing War in Iraq, while also responding to terrorists events in California and Virginia. Participants examined decisions made by Federal, state, and local agencies throughout the course of the disaster. Scenario briefings described the progress of events, as well as Federal, state, and local activities that would be underway. Special topic briefings were presented to educate participants and clarify new concepts. The exercise involved response, recovery, and

preparedness efforts surrounding a multi-disaster event from the Federal, state, local, and regional perspectives. Also discussion involved contingency planning, resource availability, and interagency coordination to successfully meet short and long term needs resulting from the disaster. Recurring themes were COOP, including plans and alternate headquarters responsibilities, staffing shortfalls, and resources. Senior leaders were required to conceptualize operations under which the priorities, capabilities, and needs of all partners and customers

in a disaster operation are synchronized over the operational continuum. While the HQTTEX scenario opened the door on a large number of topics, the focus of the exercise was the plan of action for the Federal Response Plan's (FRP) Emergency Support Function (ESF) #3 – Public Works and Engineering, for which USACE is designated the operating agent for Department of Defense (DOD). For National Emergency Preparedness fiscal year obligations and expenditures, see Table C.

Section Break (Next Page)

Section Break (Continuous)

**TABLE C**  
**NATIONAL EMERGENCY PREPAREDNESS**

Obligations	
Unobligated Balance - 30 Sep 02	\$ 1,507,472
Appropriations FY 03	\$ 4,000,000
Total Funds Available	\$ 5,507,472
Obligations FY 03	\$ 3,508,868
Unobligated Balance - 30 Sep 03	\$ 1,517,710
Expenditures	
Unexpended Balance - 30 Sep 02	\$ 2,461,011
Appropriations FY 03	\$ 4,000,000
Total Funds Available	\$ 6,461,011
Expenditures FY 03	\$ 3,382,071
Unexpended Balance - 30 Sep 03	\$ 2,598,047

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A HQUSACE Table-Top Exercise (TTEX) was held on 4 May 2004 in Washington, DC. The format of the TTEX was revised from previous events in that it was not executed as a scenario driven tabletop exercise, but rather as a "HQUSACE Round Table" discussion with a general theme of "Readiness in the USACE 2012 Environment." The primary goal of the HQTTEX was to provide a facilitated forum in which senior HQUSACE staff principals and MSC representatives could work together to ensure continued readiness to respond to any contingency by reviewing preparedness/response roles and expectations; identifying, through focused discussions, critical issues or shortfalls associated with the ongoing implementation of the USACE 2012 organization and new management tools while supporting the Global War on Terrorism and the Initial National Response Plan (INRP). Main topics included USACE 2012, Readiness XXI, New Initiatives e.g., National Response Plan (NRP)/National Incident Management System (NIMS), Catastrophic Incident Response Plan (CIRP), Port Readiness, and USACE Continuity of Operations (COOP).

## CIVIL EMERGENCY MANAGEMENT ACTIVITIES

**Authority.** Public Law 84-99 (33 U.S.C. 701n) (69 Stat. 186) provides the authority for the U. S. Army Corps of Engineers to provide a full spectrum of emergency management/disaster assistance activities using the Flood Control and Coastal Emergencies (FCCE) appropriation. Under PL 84-99, the Chief of Engineers, acting for the Secretary of the Army, is authorized to undertake activities including disaster preparedness for all natural disasters, Advance Measures (preventive measures when faced with an imminent threat of unusual flooding), emergency operations (Flood Response and Post Flood Response), rehabilitation of flood control works damaged by flood or coastal storm, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provision of emergency water due to drought or contaminated water source. Under The Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.) (88 Stat. 143) (The Stafford Act), the Federal Emergency Management Agency (FEMA) may direct USACE to use its resources to provide assistance in the event of a major disaster or emergency declaration by the President. Under The Stafford Act and its implementing National Response Plan, USACE has a standing mission to provide assistance in the area of Public Works and Engineering, Emergency Support Function #3, for response to a major disaster or catastrophic event.

**Activities.** Overall, the Civil Emergency Management Program ensures timely, effective, and efficient disaster preparedness, response, recovery, and mitigation projects and services on a nationwide basis to reduce loss of life and property damage under DOD, USACE, FEMA, and other agencies' authorities. Major disaster preparedness activities included: the review and updating of disaster preparedness and response plans to ensure viability; training personnel to ensure their capability to respond to disasters; procurement and pre-positioning of critical equipment and supplies which would likely not be available during initial stages of a response; periodic exercises to test and evaluate plans, personnel and training; and the inspection of Federal and non-Federal flood control projects to ensure their viability to provide flood protection.

For each specific event, as needed, Headquarters augments its staff and the staffs of the impacted division/district(s) to manage the event, addressing areas such as resource allocations (dollars and people), funding emergency contracts, purchasing needed materials, providing technical and direct assistance, the logistics of moving people and materials, and coordinating with tribal/Federal/state/local agencies involved in the event. These augmentation activities include overtime for Headquarters, funding of field staff, emergency contracts, travel to the event area, purchasing materials and supplies, increased staffing to include providing Remote Sensing/ Geographic Information System (RS/GIS) services.

**Significant Events.** In Fiscal Year 2005, the U.S. Army Corps of Engineers (USACE) provided approximately \$2.4 billion in direct expenditures under Flood Control and Coastal Emergency authorities and provided over \$4.4 billion in reimbursable support to FEMA.

All districts and divisions played direct or supporting roles in USACE disaster response in FY2005. The 2005 disaster season was highlighted by the three successive major hurricanes to hit states in the Gulf Coast. Texas, Louisiana, Mississippi, Alabama and Florida were all affected by Hurricanes Katrina, Rita and Wilma.

At the beginning of FY05 USACE provided both 84-99 and Stafford Act support to communities in West Virginia affected by annual flooding.

Drought assistance was provided to the Cheyenne River Sioux Tribe to construct a temporary water intake on the Missouri River.

Technical assistance was provided by the Cold Regions Research Engineering Laboratory to several areas in New England suffering from ice jam flooding.

ESF#3 Team Leaders mobilized for several National Security Special Events. No incidents occurred, but the mobilizations were used for training purposes.

## **REPORT OF THE SECRETARY OF THE ARMY ON CIVIL WORKS ACTIVITIES FOR FY 2005**

The Hurricane Season began early with Hurricane Dennis making landfall on the west coast of Florida, it wasn't a major event, but was the start of a very long and destructive season. In late August, Hurricane Katrina came ashore on the coast of Louisiana and Mississippi, causing catastrophic damage on the coast and in the city of New Orleans, where the flood protection system failed. This proved to be the largest Natural Disaster in US history. One month later Hurricane Rita hit Louisiana and Texas, causing significant damage to the coast line. Finally Hurricane Wilma, which at one point was the strongest Hurricane ever measured made landfall on the west coast of Florida and caused significant damage through to the east coast. The season stretched the entire corps resources and energy. Over 8000 Corps employees were deployed from their home station to assist in response and recovery operations. In total the Corps provided 193,000 temporary roofs, 103 million liters of water, 232 million pounds of ice, and 900 large generators. In addition, the Corps removed 50 million cubic yards of debris, un-watered the city of New Orleans, installed over 1000 temporary public facilities units, and managed the building and home safety mission that assessed the structural integrity of over 150,000 structures. At the end of FY 05 several thousand Corps employees remained deployed in Florida, Louisiana, Texas and Mississippi and many of the recovery missions were still on-going.

Hurricanes Katrina, Wilma and Ophelia caused significant damage to the flood protection and hurricane protection projects in the gulf coast and south Atlantic states. Hurricane Katrina caused extensive damages to hurricane shore protection and flood control projects in Louisiana, Mississippi and Alabama totaling over \$2.1 billion dollars. Damages to the storm protection system in the New Orleans area included major breaches to significant sections of levee and floodwalls on the Lake Pontchartrain and Vicinity and New Orleans to Venice Projects that required major repairs prior to the beginning of hurricane season 2006. In September 2005 MVD established Task Force Guardian to plan, direct and complete major

repairs to the protection system prior to 1 June 2006. Task Force Guardian is managing approximately \$800 million of repairs and improvements to the Lake Pontchartrain and New Orleans to Venice Projects. Hurricane Katrina also caused significant damages to approximately 19 projects in Mississippi and Alabama. The total cost of repairs to these projects was estimated at approximately \$43 million. Damages to projects caused by hurricanes Ophelia and Wilma in the states of Florida, North Carolina and South Carolina were estimated at approximately \$40 million.